

# **Green-Horse Habitat Restoration and Maintenance Project**

## **Biological Evaluation/Biological Assessment for Botanical Species**

**and**

## **Supplementary Botany Report**

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# Biological Evaluation

## Introduction

The purpose of this biological evaluation/supplementary report is to review the proposed Green-Horse Habitat Restoration and Maintenance project (hereafter referred to as the Green-Horse project) in sufficient detail to determine whether the proposed action would result in a trend toward Federal listing of any Sensitive plant, lichen, or fungi species, as designated by the July 3, 2013 Region 5 Sensitive Species List and Forest Plan Endemic (FPE) botanical species.

Additionally, effects are analyzed in supplementary reports for Survey and Manage, Watch list, and non-native invasive botanical species. Effects to the aforementioned botanical species that would result from taking no action – “No Action alternative” (Alternative 1) – or from taking action through implementing either the “Proposed Action” (Alternative 2) or “No Forest Plan Amendment” (Alternative 3) are analyzed. The project purpose and need is identified in the EIS.

## Project Summary

### *Location*

The Green-Horse project is located within part of the larger Klamath Mountain Bioregion – the Eastern Klamath Mountains Subsection (M261Ai) within the Klamath Mountain Ecological Section of California<sup>1</sup>. Specifically, the project area is on the Shasta-Trinity National Forest – National Recreation Area (NRA) Management Unit – within the Pit Arm, Squaw Arm and McCloud Arm watersheds (HUC5) approximately 13 miles northeast of Redding in western Shasta County (figure 1). The project area encompasses 46,356 acres; however, the proposed treatments would occur in either 41,836 (proposed action) or 13,275 (Alternative 3) acres of the project area (see below and figure S-1 in the EIS). The Green-Horse project area primarily consists of federal lands with minor amounts of private inholdings. The project area occurs within the Mount Diablo Meridian in the Bella Vista, Devils Rock, Goose Gap, Minnesota Mtn. and O’Brien Quadrangles, with the following legal descriptions:

- T33N, R30W, Sections 1-3
- T34N, R10W, Sections 6-7
- T34N, R20W; Sections 1-12; 15-21; 28-32
- T34N, R30W; Sections 1-31; 33-36
- T34N, R40W; Sections 1; 11-14; 23-27
- T35N, R10W, Section 31
- T35N, R20W, Sections 8-11; 13-16; 20-36
- T35N, R30W, Sections 29-34

The project area consists of seven management prescriptions and four land allocations as described in the Shasta-Trinity National Forest Land and Resource Management Plan (LRMP or Forest Plan). Of the seven management prescriptions in the project area (Limited Roaded

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<sup>1</sup> Miles and Goudey, 1998

S.R. Miles, C.B. Goudey Ecological subregions of California: Section and subsection descriptions, R5-EM-TP-005-NET. USDA Forest Service, Pacific Southwest Region, San Francisco, CA (1998)

Motorized Recreation, Roaded Recreation, Wildlife Habitat Management, Late-Successional Reserve, Commercial Wood Products, Riparian Reserve, Special Management Area – RNA), approximately two-thirds of the proposed treatment areas are located within two prescriptions: Limited Roaded Motorized Recreation and Roaded Recreation. The project area includes portions of two LRMP Management Areas: Management Area 8 – National Recreation Area (Shasta Unit) and Management Area 12 – Nosoni. See ‘Existing Conditions’ section within this report for descriptions regarding the physical environment, climate, and vegetation/botanical species conditions within the project area.

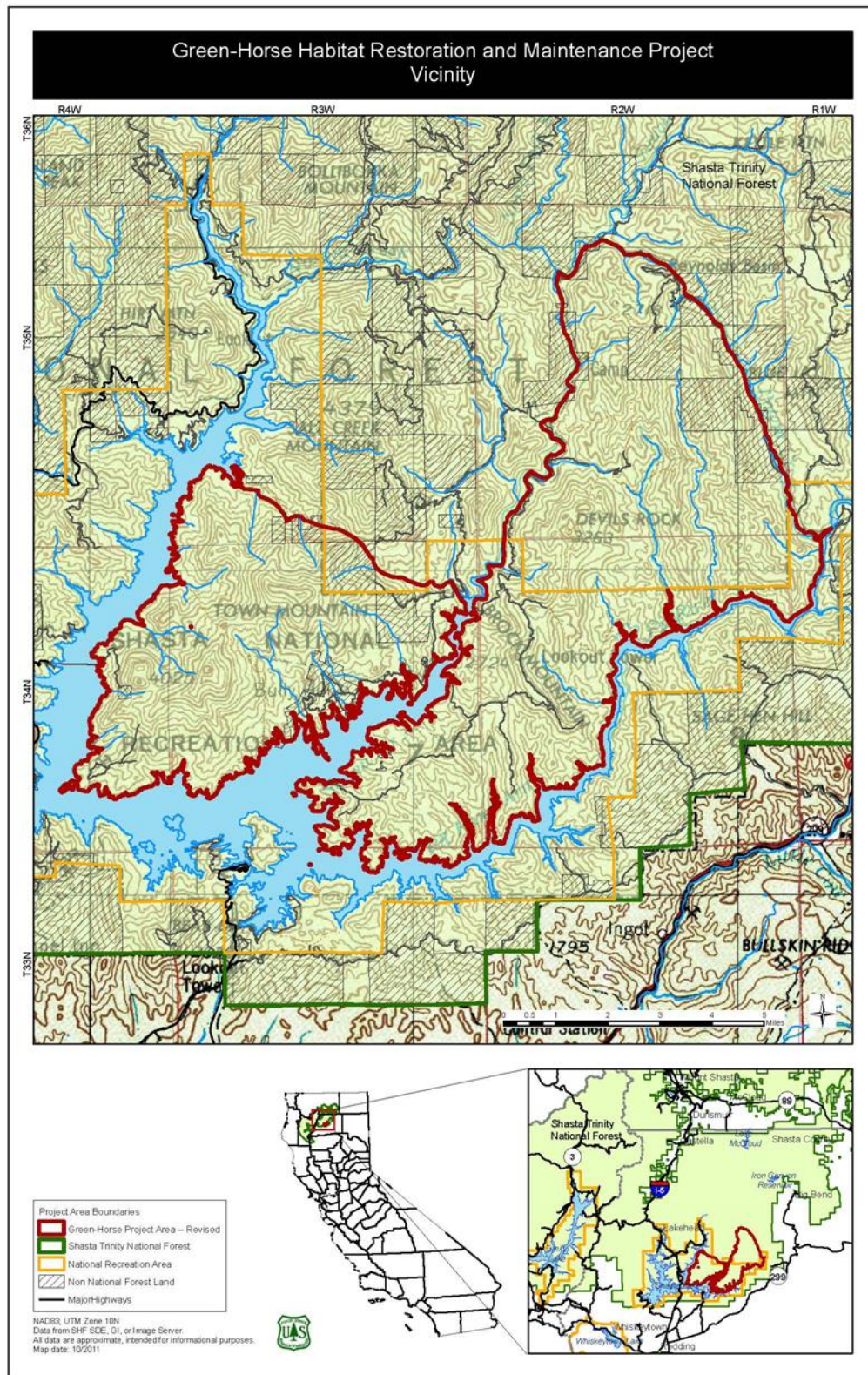


Figure 1. Green Horse Habitat Restoration Project Vicinity Map



## *Proposed Action*

Comments received during the scoping period resulted in a minor revision of the proposed action. The revision is noted in italic text below and is described in detail in Chapter 2 (Alternative 2 – Proposed Action [Revised]).

The Green-Horse project would establish a trend toward the desired conditions as described in the Forest Plan by reducing fuel accumulations on approximately *41,836 acres*. This would be accomplished by addressing an underlying purpose and need<sup>2</sup> with the following activities:

- Prescribed broadcast burning or underburning<sup>3</sup> would occur on approximately *41,625*<sup>4</sup> acres.
- Hand thinning and pruning of small trees and brush, followed by hand piling and pile burning or underburning, would occur on approximately 88 acres adjacent to private property.
- Hand thinning and pruning of small trees and brush, followed by hand piling and pile burning, would occur on approximately 35 acres surrounding recreation residences at Campbell Creek.
- Hand thinning and pruning of small trees and brush, followed by hand piling and pile burning or underburning, would occur on approximately 83 acres surrounding bald eagle nest sites.
- Approximately 4.61 miles (4 acres) of dozer line would be constructed or reconstructed in order to assist fire managers in safely conducting prescribed fire.

Fuels treatments would occur over a period of 7 to 10 years, and an adaptive management strategy would allow managers to adjust treatments over time if they discover new information or changed conditions. The proposed action does not include any commercial timber harvest, new forest system or temporary road construction, or existing road reconstruction.

In order to proceed with this project, we are also proposing a project-level LRMP amendment that would allow us to reduce dead and down material requirements in specific areas where current Forest Plan direction conflicts with both the desired fuel levels and the capacity of those areas to meet Forest Plan standards. See Chapter 2 of the EIS for a detailed description and map of the proposed action (Alternative 2), as well as an explanation of the Forest Plan amendment (Alternative 3).

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<sup>2</sup> 40 CFR 1502.13

<sup>3</sup> Broadcast burning is a prescribed burning activity where fire is applied generally to most or all of an area within well-defined boundaries for reduction of fuel hazard, as a resource management treatment, or both. Broadcast burning typically consumes portions of all strata of the fuel profile. By contrast, underburning typically consumes surface fuels such as needle cast and leaf litter, understory brush/shrubs, excess regeneration - or regeneration from undesired species - and coarse woody material, while preserving the integrity of the overstory canopy.

<sup>4</sup> The amount of prescribed broadcast burning or underburning originally proposed was 41, 637 acres. This amount – which was the result of a mapping error – has been corrected to 41,625 acres.

# Regulatory Framework

## Policy, Laws, and Direction

The following current laws, policy, and direction related to botanical species apply to the Green-Horse project:

- Section 7 of the Endangered Species Act [19 United States Code 1536(c)]
- National Environmental Policy Act of 1969 (Public Law 94-52 [42 U.S. C. 4321-4347])
- Shasta-Trinity National Forest Land and Resources Management Plan<sup>5</sup>
- Forest Service Manual (FSM) 2080: Wildlife, Fish, and Sensitive Plant Management, Section 2670<sup>6</sup>
- Healthy Forest Restoration Act and Healthy Forests Initiative (2003)
- USDA Forest Service. 2001. Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage Protection Buffer, and other Mitigation Measures, Standards and Guidelines.

In particular, Section 7 of the Endangered Species Act of 1973, as amended, and Forest Service Policy (FSM 2670) directs federal departments and agencies to ensure that “*actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitats*” and that impacts not result in loss of species viability or create significant trends toward federal listing for species listed as Sensitive by the Region 5 Regional Forester.<sup>7</sup>

See Chapter 1 of the EIS for additional applicable laws, executive orders, policy and other guidance related to the Green-Horse Project.

## *Land and Resource Management Plan*

The Shasta-Trinity National Forest Land and Resource Management Plan (LRMP)<sup>8</sup> provides integrated levels of guidance which may aid in project analyses. These include: (1) Forest-wide direction (Goals, Objectives, and Standards and Guidelines), (2) Management Prescription Direction and (3) Management Area Direction.<sup>9</sup>

The following is specific direction found within the LRMP applicable to the Green-Horse project.

## **Forest Goals**

### *Biological Diversity*

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<sup>5</sup> USDA Forest Service 1995

<sup>6</sup> USDA Forest Service 2005

<sup>7</sup> Ibid.

<sup>8</sup> Ibid.

<sup>9</sup> LRMP p. 4-1

- Integrate multiple resource management on a landscape level to provide and maintain diversity and quality of habitats that support viable populations of plants, fish, and wildlife.<sup>10</sup>

#### *Threatened, Endangered, and Sensitive Species (Plants and Animals)*

- Monitor and protect habitat for federally listed threatened and endangered (T&E) and candidate species. Assist in recovery efforts for T&E species. Cooperate with the State to meet objectives for State-listed species.<sup>11</sup>
- Manage habitat for sensitive plants and animals in a manner that will prevent any species from becoming a candidate for T&E status.<sup>12</sup>

#### **Forest-Wide Standards and Guidelines<sup>13</sup>**

- Map, record, and protect essential habitat for known and newly discovered Sensitive and endemic plant species until conservation strategies are developed.
- Analyze the potential effects of all ground-disturbing projects on Sensitive and endemic plants and their habitats. Mitigate project effects to avoid a decline in species viability at the Forest level.
- Monitor the effects of management activities on Sensitive and endemic plants. If monitoring results show a decline in species viability, alter management strategy.

#### **Management Prescription Direction – Standards and Guidelines**

##### *Management Prescription II – Limited Roaded Motorized Recreation<sup>14</sup>*

- “Shaded fuel breaks may be constructed and maintained consistent with ecosystem management plans.”
- “Design vegetative manipulation to meet recreation, wildlife, and forest health objectives within the context of an ecosystem management plan.”
- “The use of mechanized equipment is permitted.”
- “Manage hardwoods for sustainability on a landscape basis consistent with desired future ecosystem conditions.”

##### *Management Prescription III – Roaded Recreation*

- “Manage hardwoods for sustainability on a landscape basis consistent with desired future ecosystem conditions.”<sup>15</sup>

##### *Management Prescription VI – Wildlife Habitat Management*

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<sup>10</sup> LRMP p.4-4

<sup>11</sup> LRMP p.4-5

<sup>12</sup> Ibid.

<sup>13</sup> LRMP p.4-14

<sup>14</sup> LRMP 4-47

<sup>15</sup> LRMP 4-65

- “Manage hardwoods for sustainability on a landscape basis consistent with desired future ecosystem conditions.”<sup>16</sup>

*Management Prescription VII – Late-Successional Reserve and Threatened, Endangered and Selected Sensitive Species*<sup>17</sup>

- “Maintain dead/down material, hardwoods, and snags at naturally occurring levels.”
- “Conduct inventories of known populations, habitat analysis, and field reconnaissance for potential populations in project influence zones.”
- “Known sensitive plants, and those identified in the future, will be afforded the protection necessary to maintain or increase populations. Suitable habitat will be maintained or increased at a level that will assure the successful survival of the species throughout their range.”
- “Modify projects so that sensitive plants will not be jeopardized; document such action. If actions that may have an adverse effect on sensitive species cannot be avoided, the activity will be deferred until such time as the effect of the proposed action can be assessed. Subsequent action will follow the recommendation resulting from such study, (i.e., protection, mitigation or action as planned).”
- “Information pertaining to numbers, distribution, population dynamics, and response to the management of Forest sensitive plant species will be recorded and communicated to the Regional Office annually. Forest personnel will make recommendations to the Region for status revision or retention.”

*Management Prescription X – Special Area Management*

- “No natural fuels treatments or construction of shaded fuel breaks will be made within RNAs without appropriate planning and approval by the Research Natural Area Committee.”<sup>18</sup>
- “Management activities within RNAs should be compatible with the objective of the establishment report and any guidelines developed by RNAC.”<sup>19</sup>

## **Management Area Direction**

**Management Area 8 – National Recreation Area (Shasta Unit):** Vegetation is managed to a level that results in healthy forest stands, maintenance of wildlife habitat, good scenic quality, public health and safety, and reduction of fire hazards. Within designated conservation areas and bald eagle and peregrine falcon nest territories, vegetation is managed for habitat enhancement to retain critical habitat elements over the long term.<sup>20</sup>

Threatened, endangered, and sensitive species management focuses on protecting, enhancing, and restoring their habitat.<sup>21</sup>

Forest stand densities are managed to protect forest health and vigor recognizing the natural role of fire, insects and disease and other components that have a key role in the ecosystem. Stand

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<sup>16</sup> LRMP 4-72

<sup>17</sup> LRMP 4-44

<sup>18</sup> LRMP 4-49

<sup>19</sup> LRMP 4-50

<sup>20</sup> LRMP 4-112

<sup>21</sup> Ibid.

understories appear more open with less ingrowth particularly in stands on sites where wildfire plays a key role in stand development.<sup>22</sup>

Search for additional populations of Shasta snow-wreath and Scott Mountain fawn lily. Avoid disturbance pending completion of a conservation strategy.

**Management Area 12 – Nosoni:** A large portion of the area is managed to maintain and enhance late successional and “Old Growth” forests and aquatic ecosystems within the Late-Successional and Riparian Reserve systems.

Forest stand densities are managed at levels to maintain and enhance growth and yield to improve and protect forest health and vigor recognizing the natural role of fire, insects and disease and other components that have a key role in the ecosystem. Stand understories appear more open with less ingrowth particularly in stands on sites where wildfire plays a key role in stand development.<sup>23</sup>

## **Watershed Analysis Key Findings and Recommendations**

Watershed analyses (WAs) that encompass the project area recommend fuels reduction projects to reduce fire hazard, protect communities at risk, protect resource values – including rare plant populations and habitat, and improve fire suppression capabilities and firefighter safety by treating fuels (McCloud Arm WA 1998, Squaw Creek WA 1999, Clikapudi WA 2000 and Pit Arm Shasta Lake WA 2010 – all available in the project file).

## ***Categories of Plant Species of Concern***

Current management direction mandates conservation of several categories of rare plants on the Shasta-Trinity National forest.

***Endangered and Threatened (TES)*** species are those listed under the Endangered Species Act of 1973. There are no federally listed Endangered or Threatened plants known to occur on the Shasta-Trinity National Forest, nor are there any species proposed for listing. However, USFWS has declared that one species, whitebark pine (*Pinus albicaulis*) warrants protection under the Endangered Species Act (ESA), but that adding the species to the Federal List of Endangered and Threatened Wildlife and Plants is precluded by the need to address other listing actions of a higher priority<sup>24</sup>. Additionally, no critical habitat for federally listed species has been designated on the Shasta-Trinity National Forest.

***Forest Service Sensitive (FSS)*** species are those vascular plant, bryophyte, lichen, and fungi species eligible for listing under the Endangered Species Act, or whose viability is of concern. These are protected by USDA Forest Service regulations and Manual direction. The Region 5 Sensitive Plant List was updated and signed July 3, 2013. For the purposes of this report, species determined by qualified Forest personnel to be eligible for Sensitive status—and therefore anticipated to be added to the Sensitive list before implementation of the project—were analyzed as Sensitive in the Biological Evaluation.

***Forest Plan Endemic*** species are certain rare species, as designated in the Shasta-Trinity LRMP, that are confined wholly or mostly to the Shasta-Trinity National Forest. These are afforded the

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<sup>22</sup> LRMP 4-114

<sup>23</sup> LRMP 4-130

<sup>24</sup> USDI 2011

same protection as Sensitive species by direction in the Forest Plan. If present, these species are addressed in the Supplemental Botanical Report.

**Watch List** species are those that do not meet the criteria to be included on the Regional Forester's Sensitive Plant List or the LRMP, but are of sufficient local viability concern to be considered in the planning process. If present, these species are addressed in the Supplemental Botany Report.

## Analysis Methodology

### General

A pre-field review was conducted to assess occurrences of and potential suitable habitat for TES (Threatened, Endangered, or Sensitive) plants, Survey and Manage plants, and Watch List plants having the potential to occur in the Green-Horse project area. Natural Resources Information System (NRIS) and California Natural Diversity Database (CNDDB) Element Occurrence Records, the California Native Plant Society (CNPS) online Inventory of Rare and Endangered Vascular Plants of California, current peer-reviewed literature, Geographic Information System (GIS) layers from the Shasta-Trinity N.F. GIS Library (e.g., soils, elevation, 2007 CalVeg Existing Vegetation (Eveg<sup>25</sup>), Region 5 USFS Sensitive Plant Species Evaluation and Documentation forms<sup>26</sup> and personal communication with Shasta-Trinity N.F. botanical personnel – as well as other local botanical experts – were utilized for this review. Additionally the Shasta-Trinity LRMP was reviewed with respect to Management Direction to determine botany-specific guidance.

It should be noted that the potential suitable habitat for botanical species quantified in this report is likely highly overestimated as: 1) the most inclusive query was chosen for each species; 2) several considered species are habitat generalists to some degree; and 3) GIS layers are frequently at too coarse a scale (i.e., lacking in microsite information) to produce narrower, detailed habitat models.

For direct, indirect, and cumulative effects analyses the aforementioned data was used as well as GIS layers derived from fire and fuels analyses. In general, flame length and fire type (surface, passive or active crown) data were used to discuss potential severity effects on vegetation. These metrics, however, are not direct correlates to severity measures since the percent of vegetative mortality may also be a function of other factors not able to be quantified in this analysis such as residence time, smoldering combustion, etc.<sup>27</sup> See the project Fire, Fuels, Air Quality and Vegetation report for a detailed discussion on predicted future effects to vegetation (e.g., changes to composition and structure) from fire and from the action alternatives.

### Cumulative Effects

#### *Temporal Boundary*

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<sup>25</sup> See [http://www.fs.fed.us/r5/rsl/projects/frdb/layers/ev\\_mid.html](http://www.fs.fed.us/r5/rsl/projects/frdb/layers/ev_mid.html) for further information.

<sup>26</sup> USDA Forest Service 2005 and 2012

<sup>27</sup> Keeley 2009

Cumulative effects for all botanical species were analyzed for past, current, and reasonably foreseeable actions and events. The general temporal boundary for past actions is 90 years (e.g., miscellaneous fires dating back to the 1920s) and reasonably foreseeable future actions is 20 years (see table 1) from completion of project activities or, in the event of selection of the No Action alternative, 20 years from the date of the decision. The 20 year time period reflects the general boundary for the effectiveness of fuels treatments.<sup>28</sup> General trends, however, (e.g., successional trajectories) may be discussed (but not quantified) for a period of 80 years for botanical species requiring late-successional habitats (i.e., “old-growth”) for survival. Although stand development rates would vary depending on local conditions, the Northwest Forest Plan<sup>29</sup> identifies old-growth forest conditions, for those National Forests within the range of the northern spotted owl (such as the Shasta-Trinity N.F.) commencing at approximately 80 years of age.

## Spatial Boundary

The cumulative effects analysis considers the project area (46,356 acres) as the extent of alternatives effects modeling for all botanical species noted in this report with the exception of *Neviusia cliftonii* (Shasta snow-wreath; see below). The project area was chosen as the main spatial extent for the analysis because it provides: 1) the most comprehensive display of effects to vegetation conditions (overstory and understory) from implementation of the proposed action; and 2) a large enough area to capture features such as landscape-level hydrology, soil types, etc. that may influence healthy vascular plant, lichen, bryophyte, or fungi populations. For *Neviusia cliftonii*, however, the cumulative effects analysis considers all acreage within a five mile buffer around the project area (approximately 248,000 acres) as this extent contains all known occurrences of this species. Where relevant, the discussion of effects may consider past, current, ongoing, and reasonably foreseeable actions outside of either boundary (e.g., the raising of Shasta Dam) having an effect on species which occur within the analysis area. Table 1 below displays past, current, ongoing and reasonably foreseeable actions and events that were considered in the cumulative effects analysis for botanical resources.

**Table 1. Past, current/ongoing and reasonably foreseeable future actions and events – Green-Horse Habitat Restoration and Maintenance Project**

Activity	Description	*Date(s)	Location (HUC5 Watershed)	Scope
Bully Hill Mine operation	Vegetation removal, ground disturbance, toxic mine waste	1890s -1950s	Squaw Creek	Approximately 300-700 acres
Miscellaneous fires 1922-1991 (any size) 1992-present (less than 100 acres)	Wildfires	1922-present	In and adjacent to the project area	49,389 acres within analysis area
Bear Mountain Fire Salvage Timber Sale	Site prep (burning, mechanical); tree release and weed, salvage thin, tree planting	1991	Pit Arm Shasta Lake	45 acres total (18 acres within analysis area)

<sup>28</sup> Fire, Fuels, Air Quality, and Vegetation report

<sup>29</sup> USDA Forest Service 1994

Activity	Description	*Date(s)	Location (HUC5 Watershed)	Scope
Fountain Fire	Wildfires	1992	Pit Arm Shasta Lake, Burney Creek, Little Cow Creek, Lake Britton, Pit-Roaring Creek	60,289 acres total (604 acres within analysis area)
Jones Fire	Wildfire	1999	Pit Arm Shasta Lake, Little Cow Creek, and Sacramento River/Stillwater	26,202 acres total (2,074 acres within analysis area)
Green Mountain Vegetation Management Project	Prescribed fire	2001	Squaw Creek and Pit Arm	6,600 acre project area (approximately 6,100 acres complete to date)
Gilman Shaded Fuelbreak	Thin and Chip; (Thin, Pile, and Pile Burn; Pesticide application)	2003	McCloud Arm	Approximately 132 acres
Northwoods Vegetation Management	Thin, Pile, Pile burn, Underburn	2003	Pit Arm and Sacramento Arm	1,293 project area (363 acres complete to date)
Bear Fire	Wildfire	2004	Pit Arm Shasta Lake, Little Cow Creek	10,441 acres total (4,583 acres within analysis area)
Bear Fuels Fire Recovery Project (Bear Helicopter Salvage portion)	Helicopter Salvage	2005 - 2009	Pit Arm Shasta Lake	Approximately 336 acres
Clikapudi Trail Loop Addition Project	Trail Addition	2006	Pit Arm Shasta Lake	Approximately 1 mile.
SHU Lightning Complex Fires	Wildfire	2008	Pit Arm Shasta Lake, Little Cow Creek, and Pit-Roaring Creek	41,363 total (1,787 acres within analysis area)
Stein Fire	Wildfire	2008	Pit Arm Shasta Lake	1,186 acres total
Bear Hazardous Fuels Reduction Project	Thinning, piling, pile burning, replanting	2009	Pit Arm Shasta Lake	4,465 project area (350-400 acres complete to date)
Timber Harvest (Private Lands)	Timber Harvest Activities	Ongoing	Within and outside of project area	9,291 acres completed; 4962 acres approved, pending, or unlogged.
Bureau of Reclamation - Shasta Dam and Reservoir	Raising of Shasta Dam	Proposed	Shasta Dam located over 7 miles south of project area. Inundation will occur within project area.	2,498 acres of potential inundation (1,769 acres within analysis area)

Activity	Description	*Date(s)	Location (HUC5 Watershed)	Scope
I-5 Corridor Fuels Reduction Project	Fuels Reduction (Hand Thin, Prune, Pile, Pile Burn, Mastication, Rx Fire)	Proposed	Sacramento Arm, McCloud Arm, and Pit Arm Shasta Lake	20,025 treatment acres (11,691 acres within analysis area)
Packers Bay Invasive Species Removal	Removal of non-native Scotch, French & Spanish brooms using an integrated approach on NFS lands. A combination of treatments, including herbicide, manual cutting, hand pulling & prescribed fire will be used.	Proposed	Pit Arm Shasta Lake and Sacramento Arm	112 acres

*\*Note that the dates may reflect when a NEPA document decision was finalized for an action; however, the action may be ongoing (e.g., Green Mountain Vegetation Management Project).*

## Data Limitations

Limitations of data used for botanical species or habitat analyses include: 1) an inability to obtain detailed occurrence information that was deemed confidential or proprietary (e.g., North State Resources survey information); 2) current information missing from botanical databases (e.g., NRIS, NatureServe, CNDDDB); 3) vague location data for particular occurrences in these databases; and 4) partial rather than complete (100%) coverage of treatment units (41,836 acres) during botanical field surveys. See 'Field Surveys' section in the following pages for further information on botanical field surveys.

## Issues and Issue Indicators

One issue related to botanical resources was identified by the project botanical specialist and from comments received during the scoping period. The issue and issue indicators are as follows:

**Issue:** Effects of the proposed action on rare plant populations and suitable habitat

Issue Indicators:

- Season of prescribed fire ignition – in relation to the biology of the botanical species analyzed
- Predicted amounts (acres/percent) of flame lengths or fire type (e.g., surface, passive crown, or active crown) in known rare plant populations or rare plant suitable habitat within the project area - in relation to the biology of the botanical species analyzed

## Known Sites of Sensitive Species

Three FSS botanical species (*Clarkia borealis* ssp. *borealis*, *Fritillaria eastwoodiae*, and *Neviusia cliftonii*) have documented occurrences within the Green-Horse project area. See “Existing Conditions” for further information on these and other FSS botanical species. See the Supplemental Botanical Report for accounts of other botanical non-FSS species of concern (e.g., Endemic, Survey and Manage, or Watch List).

Based on presence of known occurrences or potential suitable habitat, Sensitive plant, bryophyte and fungi species of concern for this project (see Appendix A for selection criteria) are listed in table 2 below. The ‘Habitat Regional Dominance Query’ lists which vegetation types were chosen from the 2007 Eveg layer to produce potential suitable habitat acreages. Soil type (e.g., serpentine, limestone, etc.), elevation ranges, and riparian habitat information<sup>30</sup> spatial layers were also used. For further explanation and descriptions of Regional Dominance Types see the project Vegetation report and the following website:

[http://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/fsbdev3\\_046448.pdf](http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_046448.pdf)

**Table 2. Potential Sensitive Species within the Green-Horse Project area**

Scientific Name	Common Name	Organism	Habitat	Habitat Regional Dominance Query
<i>Boletus pulcherrimus</i>	red-pored bolete	fungus	Mature conifer forest.	Douglas Fir, Douglas Fir – Ponderosa Pine, Douglas Fir – White Fir, Mixed Conifer – Pine, Ponderosa Pine
<i>Clarkia borealis</i> ssp. <i>borealis</i>	Northern clarkia	vascular plant	Chaparral, cismontane woodland, lower montane coniferous forest.	All Regional Dominance types excluding ‘Reservoir’ and ‘Grassland’
<i>Cypripedium fasciculatum</i>	Brownie lady’s-slipper	vascular plant	Mixed conifer forest.	Douglas Fir, Douglas Fir – Ponderosa Pine, Douglas Fir – White Fir, Mixed Conifer – Pine, Ponderosa Pine
<i>Cypripedium montanum</i>	mountain lady’s-slipper	vascular plant	Mixed conifer forest.	Douglas Fir, Douglas Fir – Ponderosa Pine, Douglas Fir – White Fir, Mixed Conifer – Pine, Ponderosa Pine
<i>Eriastrum tracyi</i>	Tracy’s eriastrum	vascular plant	Chaparral, openings in cismontane woodlands or coniferous forest, volcanic or gravelly soils.	All Regional Dominance types excluding ‘Reservoir’ and ‘Grassland’
<i>Fritillaria eastwoodiae</i>	Butte County fritillary	vascular plant	Dry benches & slopes, woodlands lower mixed conifer openings.	All Regional Dominance types excluding ‘Reservoir’ and ‘Grassland’

<sup>30</sup> Project Fire, Fuels, Air Quality and Vegetation Report

Scientific Name	Common Name	Organism	Habitat	Habitat Regional Dominance Query
<i>Lewisia cantelovii</i>	Cantelow's lewisia	vascular plant	Moist rock outcrops/cliffs in broad-leaf & conifer forests.	Black Oak, Canyon Live Oak, Douglas Fir, Douglas Fir – Ponderosa Pine, Douglas Fir – White Fir, Mixed Conifer – Pine, Ponderosa Pine
<i>Mielichhoferia elongata</i>	elongate copper moss	bryophyte	Mesic, exposed soil or rock containing copper minerals. Foothill woodland habitats dominated by oaks or chaparral and sometimes with scattered incense cedar, Douglas-fir, and ponderosa pine.	All Regional Dominance types excluding 'Reservoir' and 'Grassland'
<i>Neviusia cliftonii</i>	Shasta snow-wreath	vascular plant	Generally north-facing slopes, sometimes on limestone-derived soils and/or within riparian zones but may also be found in drier habitats.	All Regional Dominance types excluding 'Reservoir' and 'Grassland'
<i>Phaeocollybia olivacea</i>	olive phaeocollybia	fungus	Mixed oak and pine forests.	Black Oak, Canyon Live Oak, Douglas Fir, Douglas Fir – Ponderosa Pine, Douglas Fir – White Fir, Mixed Conifer – Pine, Ponderosa Pine
<i>Sedum obtusatum</i> ssp. <i>paradisum</i>	Canyon Creek stonecrop	vascular plant	Rock outcrops in forest openings.	All Regional Dominance types excluding 'Reservoir' and 'Grassland'

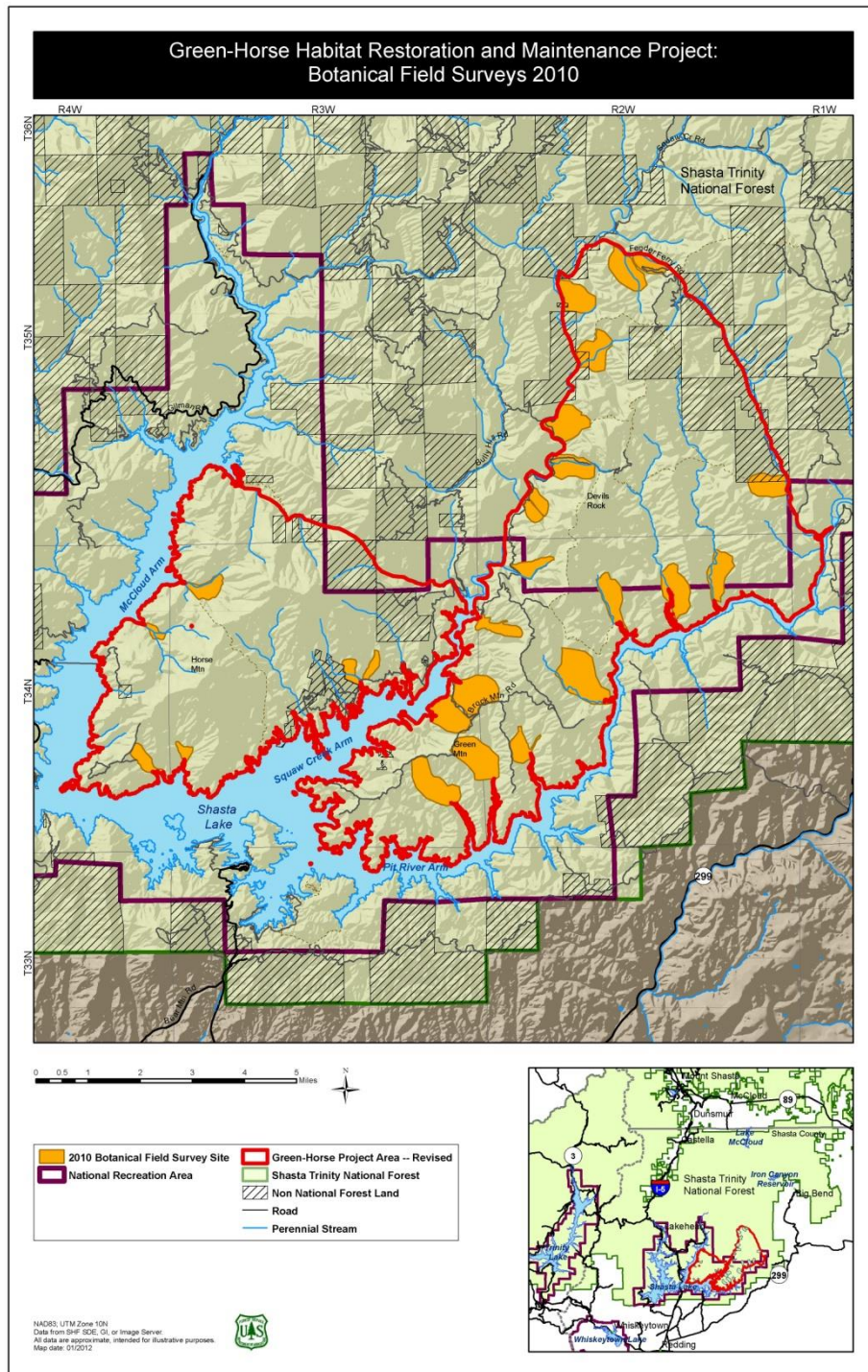
There are no known threatened or endangered plant species within the project area or on the Forest – see Biological Assessment. *Pinus albicaulis* (whitebark pine) was designated warranted for threatened or endangered status, but precluded from federal listing throughout its range on July 19, 2011 however it was added to the Region 5 Forest Service FSS list in July 2013. Whitebark pine is present on the Shasta-Trinity National Forest at elevations above 7,000 feet. Since elevations in the project area range from approximately 1,100 to 4,200 feet, project activities would be outside the elevation range of whitebark pine; therefore, there is no suitable habitat for the species within the Green-Horse project area and it will not be considered further in this report. See table A1 in Appendix A for FSS analysis selection criteria.

## Field Surveys

Field surveys (figure 2) were conducted in April and June 2010 and were targeted to the most suitable habitat for all likely FSS botanical species. Habitat for *Ageratina shastensis*, *Clarkia borealis* ssp. *borealis*, *Fritillaria eastwoodiae*, and *Neviusia cliftonii* was prioritized as these species had known occurrences and a general enough habitat affiliation to potentially overlap with other listed species. Field surveys for FSS fungi, however, must be performed during late fall or winter when soils are cool and moist. Targeted surveys for these species were not performed (incidental sightings only); therefore, occupancy for *Boletus pulcherrimus* and

*Phaeocollybia olivacea* is assumed for this analysis. All FSS botanical species surveyed for but not found that have potential suitable habitat also have assumed presence due to the inability to comprehensively cover the entire project area during field surveys.

Three new occurrences of *Fritillaria eastwoodiae* were found in the project area during these surveys. Two known occurrences of *Neviusia cliftonii* were revisited and expanded regions of occupancy were documented for both populations. No other new FSS botanical occurrences were found during field surveys. For an account of Forest Plan endemic species or noxious weeds found during these field surveys see Appendix B of this report and the Non-native Invasive Plants report for the Green-Horse project. Refer to the project file for a complete list of all botanical species (special status or non-special status) found during these field surveys.



**Figure 2. Green-Horse Project – botanical surveys**

# Affected Environment

## Existing Condition

### Physical Environment

The Green-Horse Project is located on the National Recreation Area Unit and the Shasta-McCloud Management Unit of the Shasta Trinity National Forest on National Forest System lands. The project area is geographically located within the Pit Arm Shasta Lake, Squaw Creek and McCloud Arm Shasta Lake watersheds – see project Physical Science report.

The terrain within the project area is steep and rugged, with slopes commonly exceeding 50 percent. Elevation within the project area ranges from approximately 1,065 feet to 4,325 feet with an average elevation just under 2000 feet.

Soils are varied within the project area but are predominantly formed from metavolcanic and metasedimentary rock,<sup>31</sup> although inclusions of soils with granitic, volcanic, and sedimentary parent material are present throughout the project area. No serpentine soils are mapped within the project area. There are 3,287 acres (approximately 7% of the project area) mapped as limestone rock outcrop.<sup>32</sup> There is limited water holding capacity and rooting depth of the soils within the project area and approximately 94% of soil acreage has a moderate (42%) or high (52%) Erosion Hazard Rating (EHR). See the project Vegetation and Physical Science reports for further information on the soils and their relationship to vegetation within the project area.

### Climate

The climate of the project area is described as Mediterranean, characterized by wet, cool winters and dry, warm summers. Mean annual precipitation varies from approximately 70 inches in the upper portions of the watersheds to nearly 40 inches at the lower end. About 90 percent of the precipitation falls between October and April, the majority of which occurs as rain with very little snowpack. Summer thunderstorms are common and can release significant localized rain. These storms can also be dry with conditions that encourage fire ignition and spread from lightning strikes, with an event in June of 2008 being the latest example of this pattern.

### *Climate Change*

According to the Intergovernmental Panel on Climate Change (IPCC), “Warming of the climate system is unequivocal, as is now evident from observation of increases in average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level” and the global average temperature is projected to rise approximately 10°F over the next 100 years.<sup>33</sup>

There is no apparent long-term trend in average precipitation, with considerable variability from year to year; however, many models agree that summers will be drier than they are currently, regardless of levels of annual precipitation.<sup>34</sup> These changing conditions may affect both vegetation composition and densities, and thus fire behavior, in the project area. See the project

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<sup>31</sup> Lanspa 1993

<sup>32</sup> Project Physical Science Report

<sup>33</sup> USDA Forest Service 2007

<sup>34</sup> Safford et al. 2012

Climate Change report, Fire, Fuels, and Air Quality report and Physical Science report for further information regarding climate change implications for the Green-Horse project.

## Vegetation/Botanical Species

As noted previously, the project area is within Management Areas 8 (Shasta Unit of the National Recreation Area), and 12 (Nosoni) of the Shasta Trinity National Forest<sup>35</sup>. Presence of *Ageratina shastensis* (Forest Plan Endemic), *Arnica venosa* (Forest Plan Endemic) and *Neviusia cliftonii* (Sensitive) is noted in both management units<sup>36</sup>. Forest plan direction in the Shasta Unit states that TES species management should focus on protecting, enhancing, and restoring their habitat.<sup>37</sup> Additionally, the Nosoni Unit portion of the project area contains the designated Devils Rock-Hosselkus Research Natural Area (RNA) established in 1997. This area was established because it contains a representative California black oak (*Quercus kelloggii*) vegetation type and a unique limestone ecosystem.<sup>38</sup> Additionally, this black oak element is thought to require periodic crown fire to reduce competition and succession from nearby coniferous species<sup>39</sup> (e.g. Douglas-fir [*Pseudotsuga menziesii*] and ponderosa pine [*Pinus ponderosa*]).

Vegetation within the project area (containing both Alternative 2 and Alternative 3 treatment areas) consists predominantly of (over 90% of acreage) coniferous and hardwood forest types of dense, relatively homogenous stands of medium and small-sized trees. Main vegetation alliance types include: Douglas-fir – ponderosa pine (36%), black oak (19%), canyon live oak (*Quercus chrysolepis*) (10%), and ponderosa pine types (10%). Other vegetation types occurring to a lesser extent include: lower montane mixed chaparral, Douglas-fir, mixed conifer pine, grey pine (*Pinus sabiniana*), knobcone pine (*Pinus attenuata*), whiteleaf manzanita (*Arctostaphylos viscida*), Brewer (*Quercus garryana* var. *breweri*) and interior live oak (*Quercus wislizeni*), annual grasses, upper montane mixed chaparral, and Douglas-fir – white fir (*Abies concolor*) types. See the project Vegetation report for a complete list of regional dominance types and their relative percent of acres within the project area. Some common additional shrub or understory species within the project area include: *Ceanothus* species, poison oak (*Toxicodendron diversilobum*), bracken fern (*Pteridium aquilinum* var. *pubescens*), sword fern (*Polystichum imbricans*), honeysuckle (*Lonicera* spp.), Hartweg's wildginger (*Asarum hartwegii*), vine maple (*Acer circinatum*), wild onion (*Allium* spp.), forest sedge (*Carex multicaulis*), lily sensu lato<sup>40</sup> species (*Dichelostemma* spp., *Fritillaria* spp.), Oregon grape (*Berberis aquifolium* var. *repens*), redbud (*Cercis occidentalis*), snowdrop bush (*Styrax redivivus*), violets (*Viola* spp.) and many others. See the project file for botanical survey results.

Vegetation within the 207 acres proposed for hand thinning, brush cutting, pruning, piling, and burning of hand piles and/or underburning is comprised primarily of ponderosa pine (34%), Douglas-fir - pine (31%), and black and live oak (14%) and chaparral and pine types comprising the remaining 21%.

Vegetation within the already-constructed (and to be potentially reconstructed) 4 acres of dozer lines consists of Douglas-fir – pine and Douglas-fir types (73%), black oak (18%), and canyon live oak, montane chaparral, and ponderosa pine (remaining 7%). As previously noted, specific

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<sup>35</sup> USDA Forest Service 1995a

<sup>36</sup> LRMP – Appendix P pp. 4 and 6

<sup>37</sup> LRMP pp. 4-112

<sup>38</sup> Cheng 1997

<sup>39</sup> Ibid.

<sup>40</sup> In a broader sense

information regarding these vegetation types can be found within the Vegetation report or at the following website: [http://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/fsbdev3\\_046448.pdf](http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_046448.pdf)<sup>41</sup>

Seral (i.e., successional) stages of the vegetation communities within the project area range from early-to-late. Approximately 79% of the project area is typed as mid-seral, 15% is late seral and the remaining 6% is early (see project Vegetation report). For specific information on what parameters were chosen to quantify various seral stages see the Vegetation report and the project file.

As noted previously, there are approximately 3,287 acres of limestone (some bedrock, not all ‘outcrops’) in the project area (see project Physical Science report) and vegetation types in those areas consist mainly of black oak, Douglas-fir – pine, and lower montane mixed chaparral.

There are no distinct riparian vegetation communities mapped within the project area. Riparian vegetation is generally found within the forested vegetation alliances as a subcomponent limited to narrow areas adjacent to water features. An approximation of area containing riparian vegetation was analyzed based on proximity to 5th order and larger streams within the project area resulting in a total of 686 acres of riparian vegetation types. In the Green-Horse project area this typically consists of species such as bigleaf maple (*Acer macrophyllum*), Douglas-fir, white alder (*Alnus rhombifolia*), western sweetshrub (*Calycanthus occidentalis*), willows (primarily *Salix lasiolepis*), and dogwoods (*Cornus* spp.). See the project Vegetation report for further species breakouts.

Suitable habitat is present within the project area for 14 FSS botanical species; however, only three have documented occurrences. All 14 species are analyzed in this document; however, those with known occurrences (*Clarkia borealis* ssp. *borealis*, *Fritillaria eastwoodiae*, and *Neviusia cliftonii*) are emphasized.

## Botanical Species Accounts

Information for Sensitive and those eligible for sensitive status botanical species accounts is primarily derived from Hickman 1993, Nakamura and Nelson (2001), Baldwin et al. 2012, CNDDDB (2014), NatureServe (2011), CNPS (2014), Region 5 Sensitive Plant Species Evaluation and Documentation Forms (2012 and 2013 – see project file) and personal communication with STNF botanical staff (2010-2015). Global and state ranks are based on the CNDDDB standard.<sup>42</sup> For explanations of California Rare Plant Rank (CRPR) 1-4 see <http://www.cnps.org/cnps/rareplants/ranking.php>.

**Table 3. Global/State ranks defined**

GRANK	Meaning (at species or Natural Community level)
G1 or S1	Less than 6 Element Occurrences (EO) OR less than 1,000 individuals OR less than 2000 acres
G1Q	The element is very rare, but there are taxonomic questions associated with it

<sup>41</sup> USDA Forest Service 2008

<sup>42</sup> [http://www.cnps.org/cnps/rareplants/inventory/ranking\\_system\\_mods.php](http://www.cnps.org/cnps/rareplants/inventory/ranking_system_mods.php)

GRANK	Meaning (at species or Natural Community level)
G2 or S2	6 - 20 EOs OR 1,000 - 3,000 individuals OR 2,000 - 10,000 acres
G3 or S3	21 - 100 EOs OR 3,000 - 10,000 individuals OR 10,000 - 50,000 acres
G4 or S4	Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat
G5 or S5	Population or stand demonstrably secure to ineradicable due to being commonly found in the world
Sx.1	Very threatened
Sx.2	Threatened
Sx.3	No current threats known

\* Subspecies also receive a T-rank attached to the G-rank.

## Vascular Plant Accounts

### Sensitive

*Clarkia borealis* ssp. *borealis* (northern clarkia) is an annual herb ranked as G3T2 S2.3 and CRPR 1B3. It is endemic to northern California, and locations are known only in Shasta and Trinity counties. *Clarkia borealis* ssp. *borealis* prefers somewhat early seral, cismontane (west of Sierra Nevada mountains) and foothill woodlands, chaparral, and lower montane coniferous forest habitats between elevations from 1,300 to 4,400 feet. This species is usually found in openings, including roadsides and logged or burned areas, which may indicate a possible required disturbance regime<sup>43</sup>. Additionally, since *C. borealis* ssp. *borealis* occupies early seral habitat and its seeds have no specific mechanism to aid in long-distance dispersal, populations existing as dormant seed banks may be extirpated if suitable early seral habitat is not created within the life span of the dormant seeds<sup>44</sup>. Species in the *Clarkia* genus are early successional taxa that produce small hard-coated seeds that persist in the soil for at least a few years<sup>45</sup>. Additionally, the number of seeds produced by a *Clarkia* population is many times more than that needed to replace the population, even if a small number of individuals are lost<sup>46</sup>.

There are 72 documented occurrences of this species in CNDDDB on the Shasta-Trinity NF. There are two known occurrences within the project area boundary (one on private land and the other on federal land) and 16 within five miles of the project area. Since many *Clarkia* individuals were not in flower during the time of the surveys, and that *C. borealis* ssp. *borealis* is indistinguishable from the commonly found *C. rhomboidea* until flowering, it is probable that more occurrences exist. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *C. borealis* ssp. *borealis*.

<sup>43</sup> Niederer et al. 2014

<sup>44</sup> USDA Forest Service 2012b

<sup>45</sup> McCue and Holtsford 1998

<sup>46</sup> Nelson personal communication 2014

***Cypripedium fasciculatum*** (clustered lady's slipper) is a perennial rhizomatous herb ranked as G4 S3.2 and CRPR 4.2. This species has both FSS and Survey and Manage status. It generally—but not exclusively—occurs in mid-to-late seral Douglas-fir or mixed conifer forests on a variety of soil types and often in association with riparian areas. Several stages in this species life-cycle, particularly early stages of seedling development, depend on associations with mycorrhizal<sup>47</sup> fungi. Thus habitat needs of the fungi must also be met to meet *C. fasciculatum* habitat needs. Additionally, *Cypripedium* species have a tendency to revert to dormancy during their lifecycles making monitoring and accurate accounting of population trends difficult. The currently known distribution of *C. fasciculatum* is widespread but sporadic throughout the western United States.

There are 45 documented occurrences of this plant on the Shasta-Trinity National Forest – none of which are in Shasta County. Approximately 26,463 acres (or 57% of the project area) is modeled for potential suitable habitat for *C. fasciculatum*.

***Cypripedium montanum*** (mountain lady's slipper) is a perennial rhizomatous herb ranked as G4 S4.2 and CRPR 4.2. *Cypripedium montanum* has both FSS and Survey and Manage status. Like *C. fasciculatum*, this species generally occurs in mid-to-late seral mixed conifer forests however it can be found in earlier seral forest as well. It is associated with variety of soil types and sometimes in association with riparian areas at elevations of 1300 to 6000 feet. Several stages in this species life-cycle, particularly early stages of seedling development, depend on associations with mycorrhizal fungi. Thus habitat needs of the fungi must also be met to meet *C. montanum* habitat needs. Additionally, *Cypripedium* species have a tendency to revert to dormancy during their lifecycles making monitoring and accurate accounting of population trends difficult. The currently known distribution of *C. montanum* is widespread but sporadic throughout the western United States.

There are 61 documented occurrences on the Shasta-Trinity National Forest, with only two occurring in Shasta County – the closest approximately 14 miles to the east of the project area. Approximately 26,463 acres (or 57% of the project area) is modeled for potential suitable habitat for *C. montanum*.

***Eriastrum tracyi*** (Tracy's eriastrum) is an annual herb that is experiencing some ranking updates due to recent taxonomic changes (see following). Currently it is ranked bG3Q S3 and CRPR 3.2<sup>48</sup>. First described in 1945,<sup>49</sup> *Eriastrum tracyi* has been considered a synonym with *E. brandegeae* from 1993 until recently<sup>50,51</sup>. In northern California it is found on dry, gravelly to loamy soils in annual grassland openings in cismontane woodlands, or chaparral at elevations from 1100 to 5400 feet often along disturbed roadsides. Population sizes range widely for this annual species (i.e. from 15 individuals to over 92,000). Some disturbance which would in the litter, duff and vegetation, may benefit *E. tracyi* by allowing for expression of the seedbank and by creating new habitat for this species. Additionally, the number of seeds produced by an *Eriastrum* population is many times more than that needed to replace the population, even if a small number of individuals are lost.

There are 42 populations of this species documented within Shasta County (private and public lands) – six of which are within the STNF boundary and three that are on N.F. lands. The closest

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<sup>47</sup> Mycorrhizae are symbiotic associations between a fungus and the roots of a vascular plant

<sup>48</sup> CNPS 2013

<sup>49</sup> Gowan 2008

<sup>50</sup> Ibid.

<sup>51</sup> Nelson 2012b

documented population of *E. tracyi* to the project is approximately 30 miles east of the project area on the Lassen National Forest. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *E. tracyi*. No occurrences of this plant were found during field surveys however, due to this plant's diminutive size there is the potential that occurrences were overlooked.

***Fritillaria eastwoodiae*** (Butte County fritillary) is a perennial bulbiferous herb ranked as a G3Q S3 and CRPR 3.2 species. This species distribution is limited to the Cascade Range, specifically Tehama, Butte and Shasta Counties. Although *Fritillaria eastwoodiae* can be found within chaparral and hardwood forests, within the Shasta Lake area it is found primarily in openings in lower montane coniferous forest at elevations from 1,500 to 4,900 feet. Accurate population counts are challenging since, like *Cypripedium* species, some *Fritillaria* individuals may revert to dormancy or non-flowering condition even after reaching maturity<sup>52</sup>. Since this species is found in openings, some amount of canopy opening and litter removal activity may be beneficial to this species if it is done when the plants are dormant and the bulb is not disturbed.

There are seven documented occurrences in NRIS on the Forest (22 in CNDDDB), five of which occur within the project area. *Fritillaria eastwoodiae* is also thought to potentially hybridize with other species<sup>53</sup> therefore all occurrence information may not be certain. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *F. eastwoodiae*.

***Lewisia cantelovii*** (Cantelow's lewisia) is a perennial herb ranked as G3 S3 and CRPR 1B.2. It is found on moist rock (often metamorphic or granite) outcrops or cliffs, often above streams, or occasionally serpentinite seeps, in hardwood and coniferous forests at elevations from 500 to 3000 feet. Due its perennial nature, it potentially could regenerate after disturbance however its habitat may also indicate that it is a disturbance avoider.

There are eleven documented occurrences of *L. cantelovii* on the Forest, all in Shasta County, with the closest occurrences to the project area approximately six miles to the west near Elmore Mountain. Approximately 40,433 acres (or 87% of the project area) is modeled for potential suitable habitat for *L. cantelovii*.

***Neviusia cliftonii*** (Shasta snow-wreath) is a deciduous, rhizomatous, perennial shrub ranked as G2 S2.2 and CRPR 1B.2 (i.e., rare, threatened, or endangered in CA and elsewhere). It is currently found only in the eastern Klamath Mountains in the vicinity of Shasta Lake within cismontane woodlands, lower montane coniferous forest and riparian areas although it can occur in dry substrates as well. Much of the historic extent of the species is thought to have been inundated with the creation of Shasta Lake.<sup>54</sup> This species was previously considered associated with limestone substrates; however, newer information indicates that nearly half the documented occurrences in Shasta County grow on non-limestone substrates<sup>55</sup> at elevations from 980 to 1,640 feet. Since *Neviusia cliftonii* has rhizomes, it is possible that the vegetative spread of this plant may allow for regeneration after disturbance events.

There are 21 populations of *Neviusia cliftonii* currently documented in CNDDDB however at the time of this writing three more recently found populations are being added to the database

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<sup>52</sup> Nelson personal communication 2014

<sup>53</sup> DeWoody and Hipkins 2012

<sup>54</sup> USDA Forest Service 2012b

<sup>55</sup> Lindstrand and Nelson 2006

bringing the total up to 24<sup>56</sup>. Eighteen populations occur within the Forest boundary and all of which occur within a five-mile radius of the project area. Eight of those occurrences are documented within the project area. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *N. cliftonii*.

***Sedum obtusatum* ssp. *paradisum*** (Canyon Creek stonecrop) is a perennial herb ranked G4G5T1 S1.3 and CRPR 1B.3. *Sedum obtusatum* ssp. *paradisum* is soon to be renamed *S. paradisum* subsp. *paradisum* (Nelson personal communication 2015) It can be found along broadleaf upland forest, chaparral, lower montane coniferous forest, subalpine coniferous forest, canyon live oak forest, on granitic, metamorphic, limestone and sedimentary rock types and outcrops, gravel, scree, and volcanic substrate at elevations from 2500 to 6100 feet mainly in the southern Klamath Ranges of California. Due its perennial nature, it potentially could regenerate after disturbance however its habitat may also indicate that it is a disturbance avoider

There are 26 documented occurrences in NRIS of *Sedum obtusatum* ssp. *paradisum* on the Forest not including another ten which may also be this taxon, pending current genetic and morphometric study<sup>57</sup>. Additionally, when this taxon becomes *Sedum paradisum* subsp. *paradisum* it will include most of the Shasta County populations, with the exception of the *S. kiersteadiae* on the east edge of the Trinity Ophiolite west of I-5 (Nelson personal communication 2015). The nearest occurrence of *S. paradisum* to the project area is approximately six miles to the north near Bagley Mountain. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *S. obtusatum* ssp. *paradisum*.

### Eligible for Sensitive Status

***Erythranthe taylori*** (Shasta limestone monkeyflower) is a newly-described<sup>58</sup> annual herb ranked G1G2 and CRPR List 1B.1 currently known only from the Shasta Lake region. *Erythranthe taylori* was previously thought to occur only in limestone crevices (e.g. cliff faces, outcrops) however recent (2014) botanical surveys have found occurrences on non-limestone substrates (personal communication with Julie Nelson 2014). This species is often associated with Douglas-fir (*Pseudotsuga menziesii*), Ponderosa pine (*Pinus ponderosa*) and black oak (*Quercus kelloggii*) vegetation types and occurs at 1,164 to 2,952 feet elevation.

There are 16 occurrences of *E. taylori* documented in CNDDB (2015). Four occurrences of this species are in the Green-Horse project area. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *Erythranthe taylori*.

***Erythronium shastense*** (Shasta fawn lily) is a newly-described species restricted largely to limestone outcrops near Shasta Lake, Shasta County, California. These bulbaceous plants grow in clumps in cracks and ledges on the carbonate rock substrate. Differences in the style, leaves and anthers distinguish this species from the similar *E. californicum* and *E. helenae* (York et al. 2015, in press). The leaves die back during summer until the following winter and flowers from March to April. *E. shastense* grows primarily on the north-facing or shaded limestone rock outcrops in forest and mixed woodland plant communities (York et al. 2015, in press) however it has also been located on non-limestone substrates (Nelson personal communication 2015). This species is of conservation concern due to its restricted nature on mostly on low-elevation limestone in northern California, and low number of known occurrences. Mining and possible reservoir

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<sup>56</sup> Nelson 2015 personal communication

<sup>57</sup> USDA Forest Service 2012b

<sup>58</sup> Nesom 2013

expansion of Shasta Lake, road and trail maintenance/construction, invasive species and climate change have been noted as potential threats. This species is often associated with buck brush (*Ceanothus cuneatus* var. *cuneatus*), mountain mahogany (*Cercocarpus betuloides*), Douglas-fir (*Pseudotsuga menziesii*), grey pine (*Pinus sabiniana*) and California laurel (*Umbellularia californica*).

There are approximately 19 occurrences of *E. shastense* in the Green-Horse project area<sup>59</sup> although at the time of this writing those occurrences are not yet documented in CNDDDB or NRIS. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *Erythronium shastense*.

***Vaccinium shastense* ssp. *shastense*** (Shasta huckleberry) is a newly described huckleberry endemic to the southeastern Klamath Mountains in Shasta County, CA.<sup>60</sup> This species is similar to the commonly known *V. parvifolium* (red huckleberry); however, *V. shastense* ssp. *shastense* plants have distinct genetic<sup>61</sup> and habitat differences. *Vaccinium shastense* ssp. *shastense* grows in the copper belt, along streambanks, coniferous forests, or crevices in rocky outcrops that have acidic soil and water conditions, at elevations of 1,069 – 3998 feet.

First discovered in the early 1900's, an occurrence of *V. shastense* ssp. *shastense* was located near Golinsky Mine— approximately 7.5 miles east of the project area – in 1991. It has since been found at or near other mine sites including the Bully Hill Mine area along Horse Creek within the Green-Horse project area.<sup>62</sup> The 'copper belt' extends throughout the project area therefore the entire Green Horse project is modeled for potential suitable habitat for *V. shastense* ssp. *shastense*.

## ***Bryophyte and Fungi Species Accounts***

### **Sensitive**

***Boletus pulcherrimus*** (red-pored bolete) is a mycorrhizal fungus that typically grows in mature conifer forest in relatively humid or coastal locations. Populations, if present in the project area, would most likely occur in north-facing riparian areas (mainly adjacent to perennial streams) at elevations below 5,200 feet. This species has both FSS and Survey and Manage status.

There are two known occurrences on the Forest, both within a mixed conifer vegetation type and within Trinity County. Approximately 26,463 acres (or 57% of the project area) is modeled for potential suitable habitat for *B. pulcherrimus*.

***Mielichhoferia elongata*** (elongate copper moss) is a moss ranked as G4 S2 and CRPR 2.2. It occurs in several disjunct sites in Europe, Asia, and North America.<sup>63</sup> *Mielichhoferia elongata* is found cismontane woodland on metamorphic rock and, in California, usually vernal mesic (i.e., seasonally moist) areas at elevations of 1,640 to 4,265 feet. Additionally, metamorphic, sedimentary, limestone, granite and serpentine rock outcrops that often contain copper or other heavy metals may provide habitat for this species.

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<sup>59</sup> Lindstrand 2015

<sup>60</sup> Nelson and Lindstrand 2015 in press

<sup>61</sup> DeWoody et al. 2012

<sup>62</sup> Lindstrand 2010 personal communication

<sup>63</sup> Shaw and Schneider 1995

There are six known occurrences on the Forest, all within Trinity County mainly along Highway 299. Many populations occur along roadsides and could be impacted from road realignment or Highway expansion projects. Mining could also have impacts to this species. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *M. elongata*; however, its most likely habitat is a much smaller area where the soil substrate consists of copper minerals (e.g., areas along the Bully Hill Mine/Horse Creek).

***Phaeocollybia olivacea*** (olive phaeocollybia) is a mycorrhizal gilled fungus that grows in patches within mixed forests containing oak or pine trees. It is ranked G3 and has no CNPS listing. *P. olivacea* is considered endemic to western United States from central Oregon coast south to Santa Cruz County<sup>64</sup>. Its patchy distribution precludes estimation of population size and area of occupancy. All known occurrences of this species on the Forest are within Trinity County (outside the project area).

There are 21 occurrences documented within the STNF NRIS database however all of these occurrences are a minimum of 25 miles outside the Green-Horse project area. Approximately 40,433 acres (or 87% of the project area) is modeled for potential suitable habitat for *P. olivacea*.

## Desired Condition

Desired future conditions for the project area include those of the overall Forest (Goals, Objectives, Standards and Guidelines) as well as more specific conditions outlined within the two management areas— MA 8 (Shasta Unit), and 12 (Nosoni). These are described comprehensively in the Shasta-Trinity NF Land and Resource Management Plan (LRMP or Forest Plan). See the EIS for a list of desired conditions for all resource areas. Pertinent desired future conditions are as follows:

### Overall Project

1. A fuels condition that allows for reduced fire behavior characteristics and enables a balance of fire suppression capability and fuels management investments that are cost effective and able to meet ecosystem objectives and protection responsibilities to landowners and recreationists.<sup>65</sup>
2. A vegetation and fuels condition that allows fire to resume, as much as possible, its natural role in ecosystem processes.<sup>66</sup>
3. Healthy forest stands that provide for a diversity of wildlife habitat, good scenic quality, public health and safety, and a reduction of fire hazards and risks.<sup>67</sup>

### Management Area Desired Conditions

1. Vegetation is managed to a level that results in healthy forest stands (MA 8)<sup>68</sup>.

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<sup>64</sup> Castellano et al. 2003

<sup>65</sup> USDA Forest Service 1995a, page 4-4

<sup>66</sup> Ibid, page 4-18[8d]

<sup>67</sup> Ibid, pages 4-4 through 4-6

<sup>68</sup> USDA Forest Service 1995a, page 4-112

2. Threatened, endangered, and sensitive species management focuses on protecting, enhancing, and restoring their habitat (MA 8)<sup>69</sup>.
3. The spread of weed plant populations has been arrested and native plants are being reintroduced where suitable (MA 8)<sup>70</sup>.
4. Maintain and enhance late-successional and "Old-Growth" forests and aquatic ecosystems within the Late-Successional and Riparian Reserve systems (MA 12)<sup>71</sup>
5. Forest stand densities at healthy levels that enhance forest growth and vigor while recognizing the natural role of fire, insects and disease and other components that have a key role in the ecosystem (MA 12)<sup>72</sup>.

Additionally, the Forest-wide standards and guidelines that are both specific to sensitive and endemic plant species and exemplify desired conditions for these species are noted previously in this document.

## Environmental Consequences

### Intensity of Effects<sup>73</sup>

Intensity of effects refers to the degree to which the alternative may adversely or beneficially affect botanical species or habitat.

- **Negligible:** Effects would be at the lowest levels of detection and would have no appreciable effect on resources, values, or processes.
- **Minor:** Effects would be perceptible but slight and localized.
- **Moderate:** Effects would be readily apparent and widespread, and would result in a noticeable change to resources, values, or processes.
- **Major:** Effects would be readily apparent and widespread, and would result in a substantial alteration or loss of resources, values, or processes and would likely be permanent.

### Duration of Effects<sup>74</sup>

Duration of effects refers to the general time period that the effects would impact (beneficially or adversely) botanical species or their habitat. For the purposes of this analysis, time periods of effects is broken out into "short-term" or "long-term".

- **Short-term:** Effects would be present or evident for approximately one to twenty years (or less).

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<sup>69</sup> Ibid

<sup>70</sup> Ibid

<sup>71</sup> USDA Forest Service 1995a, page 4-130

<sup>72</sup> Ibid

<sup>73</sup> Vos, 2009

<sup>74</sup> Ibid.

- **Long-term:** Effects would be present or evident for more than 20 years.

## Alternative 1 - No Action

### *Direct and Indirect Effects*

Under the No Action alternative, current management activities would not change. No fuels treatment would be implemented to address the purpose and need, and wildfire suppression would continue as directed by the forest plan with the exception of approximately 450 acres of future treatment within the Green Mountain project area (see table 1 above). Late-successional coniferous forest habitat would likely continue to develop in quality and abundance. Early-seral conifer habitat would continue to develop into mid- and late-seral habitat at current rates. Early-seral conifer areas would reduce in species diversity as tree canopies close further and shade-intolerant species drop out. With no change in current management of the project area under the No Action alternative, there would be no direct effects.

The Green-Horse project area is identified as being within a high wildfire risk area based on factors such as lightning starts, presence of human activity and presence of a hazardous fuels condition. Wildland fires and associated suppression efforts that have occurred over the past century have created a large amount of fuels, both standing and down. The continued accumulation of untreated fuels would increase the potential of high-severity fire within the project area. The effects of a wildfire on the botanical species in the project area are dependent on factors in concert with the biology of the species in question such as: 1) the season (e.g., spring, summer or fall) 2) the expected flame lengths, and 3) the type of fire (e.g., surface, passive crown, active crown), among others. If no treatment occurs, the current stand densities that have higher fuel loadings and higher fire hazard would be maintained. Not implementing the proposed action could increase the possibility of the project area experiencing high-severity wildfire (as modeled by very high flame lengths and active crown fire), which could result in various impacts to the FSS botanical species in the project area.

The following table depicts fire behavior modeling under 90th percentile conditions for the National Forest System (NFS) lands within the project area. See the project Fire, Fuels, Air Quality and Vegetation report for further details.

**Table 4: Crown fire and flame length potential on the existing landscape (NFS lands only) within the project area under 90<sup>th</sup> percentile parameters**

Crown Fire Potential (acres, %)	Unburned	Surface Fire	Passive Crown Fire	Active Crown Fire	
	241 (<1%)	12,855 (31%)	2,462 (6%)	26,064 (63%)	
Flame Length Potential (acres, %)	Very Low	Low	Moderate	High	Very High
	499 (1%)	12,064 (29%)	532 (1%)	11 (<1%)	28,516 (69%)

In addition to fire modeling, other nearby wildland fires (e.g., the Bear fire of 2004 –within 1 mile of the project area) resulted in vegetation severities that were very high for large portions of

the burned area. Nearly 20% of the Bear Fire area (over 2000 acres) suffered very high (>75%) canopy cover loss and 15% of the area (over 1600 acres) suffered very high (>90%) basal area loss. In 2012 the Bagley Complex, which occurred in the Squaw Creek watershed nearby but outside of the Green-Horse project area, grew to 46,011 acres after a lightning event started two fires. According to the Burned Area Reflectance Classification (BARC), 30% of the fire area (approximately 13,800 acres) burned at moderate and high severity resulting in considerable losses of forest vegetation.<sup>75</sup> These data were also reviewed to analyze the extent and degree of vegetation severity effects from a wildland fire event occurring in a no-action scenario within the project area.

Habitat for 11 FSS botanical species and 3 ‘eligible for sensitive status’ species occurs in the project area. These species (and their associated ecological communities) have evolved and existed in a fire-dependent ecosystem;<sup>76</sup> therefore, they may be expected to survive or respond positively to wildfire. Although one study shows that the relative severities of recent (past 20 years) fires in northwestern California have not increased, fire frequency, size, and total number of fires has increased and this shift can be associated with a changing climate.<sup>77</sup> Thus, it is unknown how resilient these Sensitive species may be to current and near-future wildfire scenarios. Responses, though, may depend on overstory vegetation types, however, such as chaparral shrub communities which have evolved to regenerate following high-intense, stand-replacing events. Burning of aboveground reproductive structures or lethal soil temperatures that can kill underground reproductive structures (e.g., the shallow rhizomes of *Cypripedium fasciculatum* or *C. montanum*), though, may cause adverse impacts to plant species.<sup>78</sup>

Ectomycorrhizal fungi (such as *Boletus pulcherrimus* and *Phaeocollybia olivacea*) are interdependent with their host trees (e.g., *Quercus* or *Pinus* spp.) exchanging nutrients, mineral and water via hyphal<sup>79</sup> networks acting as root extensions and connectors between individual trees. Due to this interdependent relationship, the vitality of these fungal species is largely dependent on their host trees. In the event of a high-intensity wildfire, host trees may be top-killed thus decreasing the vitality of these fungi.<sup>80 81</sup> Other studies have shown, though, that low-intensity wildfires do not necessarily reduce the species richness or community structure of ectomycorrhizal fungi.<sup>82 83</sup>

The downing of trees or snags during a wildfire event could also cause adverse impacts to plant species within the fall-zone of these objects. Additionally, ongoing wildfire suppression methods (as directed by the Forest Plan) could require the creation of dozer lines which could adversely impact those Sensitive species, or their habitat, which reside in the same spatial location of the necessary firelines.

In the event of an active crown wildfire (63% predicted for the project area), heavy modifications in the forest canopy could be severe enough to eliminate or reduce necessary habitat characteristics, such as shade, critical for native and rare species’ survival. In addition,

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<sup>75</sup> USDA Forest Service 2012

<sup>76</sup> Skinner et al. 2006

<sup>77</sup> Miller et al. 2012

<sup>78</sup> Knapp 2012

<sup>79</sup> Hyphae are fine, branching tubes which make up the body (or mycelium) of a multicellular fungus.

<sup>80</sup> Visser 1995

<sup>81</sup> Southworth et al. 2011

<sup>82</sup> Jonsson et al. 1999

<sup>83</sup> de Roman and de Miguel 2005

approximately 66% of the forested ecosystems and 96% of the shrub and herbaceous vegetation communities are predicted to have high levels of mortality following a wildfire event under current conditions.<sup>84</sup> In particular, species such as *Boletus pulcherrimus*, *Cypripedium fasciculatum* and *C. montanum*, and *Phaeocollybia olivacea* which often occur in mature and late-seral mixed conifer forested areas could be majorly adversely impacted over the long-term by a loss of suitable habitat from a high-severity wildfire event.

Riparian or generally mesic-associated species such as *Boletus pulcherrimus*, *Cypripedium fasciculatum* and *C. montanum*, *Lewisia cantelovii*, *Neviusia cliftonii*, or *Vaccinium shastense* ssp. *shastense* may also be affected by a loss of suitable habitat in the event of a high-intensity wildfire; however, since these species typically (although not exclusively) grow in moist environments where fire is less able to proliferate, negative impacts from these fire events may be more minor to moderate and shorter-term. If there were severe changes to the hydrologic regime<sup>85</sup> from a high-intensity fire, though, negative impacts to these species would be major and longer-term.

Similarly, species growing in more open habitats (e.g., *Clarkia borealis* ssp. *borealis*, *Eriastrum tracyi*, *Erythranthe taylori*, *Erythronium shastense*, *Lewisia cantelovii*, *Fritillaria eastwoodiae*, *Sedum obtusatum* ssp. *paradisum*,) may experience only short-term minor adverse impacts due to the limited presence of other vegetation needed to carry fire (e.g., rocky outcrops, roads); however, several of these species (e.g., *F. eastwoodiae*) tend to grow in openings within coniferous forests and cannot necessarily tolerate a complete loss of overstory canopy. Conversely, the opening of the canopy from a dense vegetative condition—in either an active or passive crown fire— would have a short-term moderate beneficial effect to these species as well.

A low-intensity surface fire (31% predicted for the project area) would damage some above-ground portions of individual plants, while underground portions would be unaffected, and plants would recover in the short term. A low-intensity surface fire within riparian/mesic habitats would likely benefit *Boletus pulcherrimus*, *Cypripedium fasciculatum* and *C. montanum*, *Lewisia cantelovii*, *Neviusia cliftonii* and *Vaccinium shastense* ssp. *shastense* populations indirectly by reducing riparian vegetation cover and competition for understory resources (moisture, substrate, soil minerals, understory light), resulting in increased viability of these populations, until riparian vegetation recovers.

A high-intensity surface fire (0.03% predicted for the project area) – hot enough to sterilize the soil to depths below 5 centimeters (2 inches) – would have adverse effects on species with requisite mycorrhizal associates (e.g., *Boletus pulcherrimus*, *Cypripedium fasciculatum* and *C. montanum*) as these critical fungi could be reduced or eliminated. In addition, soil cover (e.g., woody debris, litter, duff) could be reduced which would also adversely impact the structural stability of many plant species. Nutrients stored in the organic layer (such as potassium and nitrogen) vital for plant growth can also be lost or reduced in a high-intensity surface fire. See the project Physical Sciences report for further information.

With respect to known populations of Sensitive species, *Clarkia borealis* ssp. *borealis*, *Erythranthe taylori*, *Erythronium shastense*, *Fritillaria eastwoodiae*, and *Vaccinium shastense* ssp. *shastense* are modeled for mainly crown fire and very high flame lengths with minor mixtures of surface fire and low flame lengths. *Clarkia borealis* ssp. *borealis*, though, was noted to have

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<sup>84</sup> Project Fire, Fuels, Air Quality and Vegetation report

<sup>85</sup> Nelson 2012b

“benefited” from a mixed severity wildfires (e.g. the Fountain Fire of 1992<sup>86</sup>, the Bagley fire of 2012<sup>87</sup>); thus this species may be expected to flourish post-wildfire if the event did not take place during flowering (June-September) and/or did not reach temperatures hot enough to kill this species’ seeds residing in the duff or soil layers. Of the eight *Neviusia cliftonii* populations within the project area, all populations are also mainly predicted to fall within crown fire and very high flame length areas. A few areas within *N. cliftonii* populations, however, that are adjacent to a stream would likely experience passive crown fire and lower flame lengths than those in upland communities.

A high-severity wildfire event could also create favorable conditions (e.g., open canopy, decreased number of native species for resource competition) for noxious weed invasion. A noxious weed invasion would have the potential to displace native species via various mechanisms. As there are several known occurrences of noxious weeds in the project area at this time (see Non-Native Invasive Plant Species Report for further information), this would likely be a moderate long-term adverse effect.

### ***Cumulative Effects***

Because no action would be implemented that would be additive to other past, current and reasonably foreseeable actions in the project area, there would be no cumulative effects – according to definition provided in 40 CFR 1508.7<sup>88</sup> – to FSS botanical species with implementation of this alternative. However, if fuels are allowed to continue to accumulate untreated – with the exception of the Green Mountain project area – the likelihood of these high levels of ground and ladder fuels burning, or re-burning in the event of an unplanned fire is increased as well as the likelihood that these fuels would contribute to initiating and sustaining crown fires. This, combined with past fire suppression, past wildfires (see table 1 above) and ongoing fire suppression would create long-term effects such as a highly increased likelihood of a high-severity fire occurring, thus damaging or killing FSS botanical species as well as adversely impacting their habitat.

Adversely impacted habitats, then, would have a long-term adverse effect on FSS species abundance and distribution. Some species which may resprout from rhizomes or bulbs (*Cypripedium fasciculatum* and *C. montanum*, *Fritillaria eastwoodiae*, or *Neviusia cliftonii*), however, may remain relatively unaffected in the long-term from a wildfire event. Additionally, there are also reports of *Clarkia borealis* ssp. *borealis* having been described as ‘flourishing’ many years after a wildfire event (i.e., the Fountain Fire of 1992),<sup>89</sup> which illustrates the possibility of possible beneficial long-term effects for some species. In general, however, information is lacking and further study is needed.

In addition, in the absence of a wildfire event, denser multi-storied stands comprised primarily of shade-tolerant species (e.g., *Boletus pulcherrimus*, *Cypripedium montanum*, *C. fasciculatum*, *Phaeocollybia olivacea*) would likely increase while species such as *Clarkia borealis* ssp. *borealis*, *Eriastrum tracyi*, *Erythranthe taylori*, *Erythronium shastense*, *Fritillaria eastwoodiae*, *Lewisia cantelovii*, *Sedum obtusatum* ssp. *paradisum* and *Vaccinium shastense* ssp. *shastense* that

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<sup>86</sup> USDA Forest Service 2012b

<sup>87</sup> Nelson personal communication 2014

<sup>88</sup> 40 CFR 1508.7 states that “Cumulative impact” is the impact on the environment which results from the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions...

<sup>89</sup> USDA Forest Service 2012b

need either gaps in the canopy or a very open conditions would likely decrease in abundance, although some roadside or trailside populations may remain the same.

**Conclusion:** A low-intensity surface fire or portions of a passive crown fire would result in negligible adverse short-term direct effects and minor-to-moderate beneficial short-term indirect effects on all aforementioned botanical species. A surface fire hot enough to sterilize the soil would result in adverse short-term direct effects to all aforementioned botanical species due to severe habitat alteration and long-term moderate adverse indirect effects to *Boletus pulcherrimus*, *Cypripedium fasciculatum* and *C. montanum*. Active crown fire – or possibly some areas of passive crown fire – that removes a large percent of the overstory canopy would result in a moderate long-term adverse indirect effect to all aforementioned botanical species – with the possible exception of *Clarkia borealis* ssp. *borealis*, *Eriastrum tracyi*, *Erythranthe taylori*, *Lewisia cantelovii*, *Fritillaria eastwoodiae*, or *Sedum obtusatum* ssp. *paradisum*, which may experience short-term beneficial effects due to the opening up of the canopy and the creation of new habitat.

## Alternatives 2 and 3

### *Alternative 2 – Proposed Action*

This alternative includes 41,836 acres of fuels treatments that would be accomplished over 7 to 10 years using an adaptive management strategy on approximately 41,625 acres in the project area. It would require amending the Forest Plan to change down wood requirements in order to achieve fuel reduction objectives and protect soils in specific management prescription areas. The overall goal is to create a landscape that would provide fire managers more options in the future to allow fire to play its natural role in the ecosystem. The qualitative discussion of direct and indirect effects applies to Alternatives 2 and 3, and is presented below under Effects Common to Both Action Alternatives.

### *Alternative 3 – No Forest Plan Amendment*

This alternative includes 13,247 acres of fuels treatments that would be accomplished over 7 to 10 years using an adaptive management strategy. It would not require amending the Forest Plan to change down wood requirements as defined in Alternative 2. The overall goal is to create a landscape that would provide fire managers more options in the future to allow fire to play its natural role in the ecosystem. As noted above, the qualitative discussion of direct and indirect effects applies to both action alternatives and is presented below.

The cumulative effects of Alternatives 2 and 3 are essentially the same and are discussed below under Effects Common to Both Action Alternatives. However, the removal of 28,375 acres of treatment area within the project under Alternative 3 would reduce the effectiveness of the proposed action to those acres that are to be treated. The remaining portion of the project area would see effects similar to Alternative 1 (No Action).

## Design Features Common to Both Action Alternatives

A complete description of project design features for all resources is in Chapter 2 of the EIS. All project design features for Alternative 2 also apply to Alternative 3, with the exception of design features related to dozer line construction (which would not occur under Alternative 3). For

design features specific to noxious weeds see the Non-Native Invasive Plant Species Report for the Green-Horse project.

### *Special Status Plants and Fungi*

BOT-1 No dozer lines would be constructed within 50 feet of any documented Forest Service sensitive plant species populations. No hand lines or burn piles would be constructed and no mechanical activities would occur within 150 feet of Forest Service sensitive plant species populations unless otherwise noted.

BOT-2 The use of mechanical equipment and the creation of piles would be prohibited within areas that have limestone outcrops to protect habitat for several species (e.g., *Adiantum shastense* (Shasta maidenhair fern), *Ageratina shastensis* (Shasta ageratina), *Erythranthe taylori* (Shasta limestone monkeyflower), *Erythronium shastense* (Shasta fawn lily), and *Neviusia cliftonii* (Shasta snow-wreath).

BOT-3 For documented Shasta eupatory (*Ageratina shastensis*) populations not protected by the above-mentioned design features that occur within the prescribed underburn fire treatment areas, vegetation would be cut and removed by hand far enough from known populations (with the presence of a botanical monitor) to prevent injury to the plants from fire.

BOT-4 Prescribed fire treatments would not be allowed within 100 feet of known Shasta snow-wreath (*Neviusia cliftonii*) populations with the exception of occurrences selected for a monitoring study (see the project record for selection criteria). The following populations may be used in the study; however, if they are not selected for monitoring, the aforementioned design features would apply. The five snow-wreath sites are: EO 5 along Campbell Creek, EO 6 along Curl Creek, EO 7 along Low Pass Creek, EO 12 along Squaw Creek, and EO 17 along Flat Creek. Hand thinning and manual weed treatment would be permitted throughout populations with the presence of a botanical monitor.

BOT-5 In all areas where infestations of nonnative plant species occur with Shasta snow-wreath (identified in project record), the following actions and restrictions would occur where appropriate:

- a. If invasive nonnative plant infestations occur adjacent to the Shasta snow-wreath occurrence (e.g., Low Pass Creek), fireline would not be constructed within 100 feet of the Shasta snow wreath occurrence.
- b. Protocols for selecting specific areas with weed-adjacent rare plant populations that would be available for burning are described in the project file.
- c. Post-treatment monitoring would occur for no fewer than 2 consecutive years to assess if project-related actions have resulted in increases in weed distribution or abundances. If monitoring shows that infestations have increased, manual and mechanical treatments would be conducted.

BOT-6 Hand treatments would be allowed through veiny arnica (*Arnica venosa*), northern clarkia (*Clarkia borealis* ssp. *borealis*), Butte County fritillary (*Fritillaria eastwoodiae*), and the Shasta huckleberry (*Vaccinium shastense* ssp. *shastense*) with a limited operating period of September through February, or year-round with the presence of a botanical monitor. Otherwise, occurrences would be flagged and avoided with a 50-foot buffer.

BOT-7 Prescribed fire would be permitted through an occurrence of northern clarkia (*Clarkia borealis* ssp. *borealis*), outside of vegetative (growing – fruiting) season (i.e., April-October) with

the occurrence monitored pre and post-treatment. If monitoring finds neutral or beneficial results, prescribed fire would be permitted through all known northern clarkia occurrences.

## Effects Common to Both Action Alternatives

The actions proposed as components of Alternatives 2 and 3 could result in direct, indirect, or cumulative impacts as analyzed below. Prescriptive burn, hand thinning, hand piling, and pile burning are common to both action alternatives. Although all proposed treatments will be addressed, since the vast majority (over 99%) of the acreage within either alternative is proposed for prescribed burn the main focus of the analyses will be on the effects from this treatment. As noted previously, the predicted effects from the implementation of prescriptive burns are generally assessed by using flame length potential and crown fire potential as methods to measure vegetation severity and, therefore, potential effects to botanical species.

The following table displays expected outcomes from the application of prescribed burns as well as a post-treatment wildfire event within the treatment units for Alternatives 2 and 3. See the project Fire, Fuels, Air Quality and Vegetation report for specific information on how these values were derived.

**Table 5: Crown Fire and flame length potential for prescribed fire and post-treatment wildfire (90<sup>th</sup> percentile) parameters for Alternatives 2 and 3**

Alt 2 Rx Fire	Crown Fire Potential (acres, %)	Unburned	Surface Fire	Passive Crown Fire	Active Crown Fire	
		241 (<1%)	37,468 (90%)	3,913 (9%)	0 (0%)	
	Flame Length Potential (acres, %)	Very Low	Low	Moderate	High	Very High
		23,270 (56%)	18,118 (43%)	106 (<1%)	30 (<1%)	97 (<1%)
Alt 2 Wildfire	Crown Fire Potential (acres, %)	Unburned	Surface Fire	Passive Crown Fire	Active Crown Fire	
		241 (<1%)	36,256 (87%)	3,458 (8%)	1,666 (4%)	
	Flame Length Potential (acres, %)	Very Low	Low	Moderate	High	Very High
		28,716 (69%)	7,740 (19%)	896 (2%)	1,101 (3%)	3,168 (8%)
Alt 3 Rx Fire	Crown Fire Potential (acres, %)	Unburned	Surface Fire	Passive Crown Fire	Active Crown Fire	
		2 (<1%)	12,644 (95%)	601 (5%)	0 (0%)	
			Very Low	Low	Moderate	High

	<b>Flame Length Potential</b>	8,863 (67%)	4,337 (33%)	21 (<1%)	6 (<1%)	20 (<1%)
<b>Alt 3 Wildfire</b>	<b>Crown Fire Potential (acres, %)</b>	<b>Unburned</b>	<b>Surface Fire</b>	<b>Passive Crown Fire</b>	<b>Active Crown Fire</b>	
		2 (<1%)	12,326 (93%)	384 (3%)	535 (4%)	
	<b>Flame Length Potential (acres, %)</b>	Very Low	Low	Moderate	High	Very High
		9,987 (75%)	2,286 (17%)	160 (1%)	118 (1%)	696 (5%)

\*Note - Re-projections of data in ArcGIS and ArcFuels can lead to geometric discrepancies (i.e., differences in acreage) of less than 1%. All resultant acres are approximate.

## Direct Effects

### Prescribed Burn

The most significant direct effect of prescriptive burn (for either action alternative) would be the consumption of plant tissues – above or below ground – and the potential resulting mortality of individual plants or fungi. Prescribed burning within the project area, though, is estimated to result in low-severity impacts to botanical species due to the low flame lengths and absence of active crown fire expected from implementation (see table 5 above). Ninety to 95 percent of the acres within Alternatives 2 and 3 treatment units, respectively, are projected to result in surface fire with the remainder predicted to result in passive crown fire. All surface fire in the project area is modeled as low intensity and thus would likely result in a low level of plant or fungi mortality; however, it is possible for a surface fire to burn at low to moderate intensity yet consume the forest floor and damage sprouting tissues<sup>90</sup> resulting in moderate- to high-severity impacts. This would depend on factors such as fuel moisture, residence time, etc.

Direct effects to species growing in moist environments (e.g., riparian zones, bogs, fens, seeps) would likely be negligible-to-minor due to the higher fuel moistures and humidity than those that typify drier sites. These species include: *Boletus pulcherrimus*, *Cypripedium fasciculatum*, *C. montanum*, *Mielichhoferia elongata*, *Neviusia cliftonii* and *Vaccinium shastense* ssp. *shastense*. In addition, ignition/burning within riparian reserves would be very restricted (see Chapter 2 of the EIS for details) thus lessening the impacts to these riparian-associated species.

Species growing on rocky outcrops (*Erythranthe taylori*, *Erythronium shastense*, *Lewisia cantelovii*, *Mielichhoferia elongata*, *Sedum obtusatum* ssp. *paradisum*), would likely be at low risk of direct adverse effects (i.e., mortality through burning) since there is little surrounding continuous vegetation within that habitat to carry fire, although if sufficient surrounding vegetation were present individuals could be killed. Species such as *Clarkia borealis* ssp. *borealis* and *Fritillaria eastwoodiae* also grow in somewhat open-canopy and/or disturbed areas thus direct adverse effects would be minimal. Prescribed fire treatments, though, would not be allowed within 100 feet of known northern clarkia (*Clarkia borealis* ssp. *borealis*), unless there is

<sup>90</sup> Brown and Smith 2000

evidence, approved by the Forest botanist, that shows the impacts of prescribed fire to be neutral or beneficial – thus minimizing potential direct adverse effects to this species. Additionally, as *F. eastwoodiae* species is a bulb, application of a low-intensity surface fire should not damage critical below-ground tissues of this plant.

The loss of habitat for these species should be minor also due to the low vegetation severity expected from very low flame lengths and low intensity of surface fires. *Lewisia cantelovii* exists in very wet outcrops which would have an extinguishing effect on creeping fire. If rock outcrops were utilized for natural barrier during prescribed fire operations some negligible short-term adverse effects (i.e., trampling) could occur. The potential direct adverse effects to these species would be minor and short-term due to the aforementioned factors.

Although it has been shown that there is a loss of fungal biomass in the upper litter and soil layers following surface fire<sup>91 92</sup>—particularly after a fall burn—which could have a minor adverse effect on the vitality of species such as *Boletus pulcherrimus* and *Phaeocollybia olivacea*, it has also been shown that mycorrhizal associates can survive in the deeper portions (below 5cm) of the mineral soil<sup>93 94</sup> where a low-intensity surface fire would likely not penetrate. In particular, *P. olivacea* has an extremely long stipe that can extend for more than 0.3 meters into the soil. Additionally, these species typically fruit during wetter periods of the year which is often in contrast to optimal conditions for the application of prescribed fire. Therefore, above-ground fruiting bodies would likely not be present during time of implementation; however, this is not a certainty. Due to these aforementioned reasons, adverse effects to these species would likely be negligible-to-minor.

Since *Neviusia cliftonii* was only recently discovered in the Shasta Lake region, and *Erythranthe taylori*, *Erythronium shastense*, and *Vaccinium shastense* were only recently described, it is unclear how long these species have persisted in the area. The historical impacts of fire or fire exclusion are therefore unknown. As previously mentioned, any direct impacts on these species within riparian zones from prescribed burning would be negligible-to-minor. Some occurrences of *N. cliftonii* and *V. shastense* exist in more upland habitats, however, and it is unknown how fire may affect populations within this ecotype. *Neviusia cliftonii* is rhizomatous, thus underground stems may produce vegetative growth if the plant is top-killed. *N. cliftonii* plants were observed to grow back after being cut for a fire break on the Waters Gulch trail.<sup>95</sup> Currently a monitoring study is underway for *N. cliftonii* —in both riparian and upland habitats— which may provide valuable information on this species in general as well as its response to fire in particular. Three of the eight known occurrences within the project area (one of the four in Alternative 3 proposed treatment areas) – Campbell Creek, Curl Creek, and Low Pass, Creek – have been chosen for this study (see the project file for selection criteria), and one population within the five-mile analysis area has already had prescribed fire applied to it. Although no formal analysis has been completed on this study, anecdotal observations have noted a vigorous resprouting response from *N. cliftonii* plants within the prescribed burn areas<sup>96</sup>. Design features excluding prescribed fire within 100 feet of all other known occurrences would minimize direct adverse impacts from prescribed fire for these species.

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<sup>91</sup> Stendell et al. 1999

<sup>92</sup> Smith et al. 2004

<sup>93</sup> Ibid.

<sup>94</sup> Visser 1995

<sup>95</sup> USDA Forest Service 2012b

<sup>96</sup> Butz 2013 personal communication

According to a recent species account, *Eriastrum tracyi* appears to tolerate or benefit from infrequent disturbance and wildfire<sup>97</sup>. This species could be directly consumed via surface fires; however, no occurrences for this species are known to exist within the project area. Habitat suitability may also be directly adversely impacted; however, surface fire is unlikely to completely remove the cismontane woodland forests or chaparral habitats thus a direct effect would be minor and short term.

Timing or season of implementation of prescribed burn may also affect its impacts to FSS botanical species. Although conditions specified in the burn plan will dictate the ability to apply prescribed fire, it is also likely that periods during which the aforementioned species would be flowering would indicate conditions outside of the burn plan (e.g., too-high fuel moistures); however, this is not absolute.

### **Hand Thin, Prune, Pile Burn**

These treatments would take place on approximately 207 acres under Alternative 2 and on 28 acres under Alternative 3. See Chapter 2 of the EIS for specific descriptions of treatment units. Small conifer trees up to eight inches in diameter would be thinned, removing trees in a random spacing pattern of approximately 15 feet by 15 feet. Hardwood species up to four inches in diameter would also be thinned, retaining a minimum canopy cover of 75 percent where it already exists.

Project design features would ensure that hand thinning and pruning of small trees and brush should have little to no effect on known occurrences of FSS botanical species. Although trampling of species or accidental pruning of a shrub-like species such as *Neviusia cliftonii* or *Vaccinium shastense* ssp. *shastense* is possible (an adverse effect), no hand lines or burn piles would be constructed and no mechanical activities would occur within 50 feet of known occurrences of FSS plant species populations unless otherwise noted. Any hand thinning/weeding occurring near known *N. cliftonii* would be conducted with a botanical monitor present (see Chapter 2 of the EIS). Additionally, the use of mechanical equipment and the creation of piles would be prohibited within areas that have limestone outcrops to protect habitat for several species (e.g., *Ageratina shastensis*, *Erythranthe taylori*, *Erythronium shastense*, *Neviusia cliftonii*, and *Sedum obtusatum* ssp. *paradisum*). Due to these design features and the small amount of area to be treated, direct adverse effects to FSS botanical species would likely be negligible and short-term.

Pile burning would, however, result in localized areas of high soil heating under piles. As noted, identifiable FSS botanical species would be avoided. Unknown occurrences of FSS plants could be directly damaged or killed, however, if soil temperatures reach high-enough levels to adversely affect necessary reproductive tissues such as the bulbs of *Fritillaria eastwoodiae*, or the shallow rhizomes of *Cypripedium fasciculatum* and *C. montanum*. This would be a minor long-term adverse direct effect.

As for fungal species (*Boletus pulcherrimus* and *Phaeocollybia olivacea*) that may not be identifiable at the time of implementation, it is expected that because fungal and plant root biomass can reach much lower depths than 5 centimeters (2 inches)—the measure where high soil temperatures are thought to have the most damaging effects<sup>98</sup>—these species should survive this

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<sup>97</sup> Nelson 2012b

<sup>98</sup> Smith et al., 2004

type of temporary heating. It should be noted, however, that a fall burn causes higher fungal biomass loss than a spring burn.<sup>99</sup>

Although a concentrated burn may affect fungal species more intensely than a broadcast burn, the effects of piles are more localized and therefore minor. Recovery and reintroduction of any populations of these fungal species from residual fungal biomass in the areas surrounding burn piles would be expected to occur.

For species that occur within riparian reserves (e.g., *Boletus pulcherrimus*, *Cypripedium fasciculatum*, *C. montanum*, *Lewisia cantelovii*, *Neviusia cliftonii*, and *Vaccinium shastense* ssp. *shastense*) several design features would be utilized to minimize adverse impacts from pile burns within these areas (See Chapter 2 of the EIS).

Additionally, potential suitable habitat removal via hand thin, prune, or pile burn, represents a maximum of 0.5% of the available suitable habitat for all FSS botanical species modeled within Alternative 2 and 3 treatment areas. Due to this and for the aforementioned reasons, direct adverse effects to FSS botanical species would be negligible and short-term.

## **Indirect Effects**

### **Prescribed Fire**

A small portion of the acres within proposed treatment areas (approximately 5-9 percent) is projected to result in passive or active crown fire, and less than one percent would result in moderate, high, or very high flame lengths. As noted previously, the removal of overstory canopy from an active crown fire would have an adverse indirect effect to some FSS plant species due to increased solar radiation which, in turn can lead to reduced soil moisture, and increased plant evapotranspiration and desiccation.<sup>100</sup> A surface fire may also increase solar radiation (and related effects) through the removal of duff. These adverse effects, however, would be minor due to the small percentage of area projected for active crown fire. The areas projected for passive crown fire could reduce the overstory canopy within individual trees or small groups of trees (see the project Fire, Fuels, Air Quality and Vegetation report). Because passive crown fire does not typically result in a high amount of canopy removal and because only a small percentage of the project area is modeled for this outcome, the adverse effects from this would be minor and short term.

Indirect beneficial effects of passive crown fire, and/or areas with very low or low flame lengths would include the eventual development of late-successional characteristics from the opening-up of the canopy and the mimicking of natural disturbance cycles. The indirect effects of treating fuels under a prescribed burn scenario would also result in lower vegetation severities during possible future wildland fire events. Indirect beneficial effects of a low-intensity surface fire (90-95% of Alternatives 2 and 3) include a reduction in the density of surrounding vegetation and duff which would decrease competition for nutrients and light. Additionally, the cycling of these vegetation materials would release nutrients (e.g., nitrogen) for native plant use and enhance soil development and fertility over the long term. Furthermore, implementation of prescribed fire treatments prior to wildfire events is likely to reduce future wildfire burn severity thus benefitting

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<sup>99</sup> Ibid.

<sup>100</sup> Desiccation is the state of extreme dryness, or the process of extreme drying.

most Sensitive plant species in the project area. See the project Fire, Fuels, Air Quality and Vegetation report for a detailed discussion on predicted post-treatment wildfire behavior.

Indirect effects to species growing in moist environments (*Boletus pulcherrimus*, *Cypripedium fasciculatum*, *C. montanum*, *Mielichhoferia elongata*, *Neviusia cliftonii*, and *Vaccinium shastense* ssp. *shastense*) would likely be negligible to minor due to the high fuel moistures and humidity within these habitats which generally decrease the likelihood of overstory canopy consumption. A surface fire within mesic habitats would benefit the aforementioned populations indirectly by reducing riparian vegetation cover and competition for understory resources (moisture, substrate, soil minerals, understory light), resulting in increased viability of those populations, until riparian vegetation recovers. A moderate to hot surface fire could, though, indirectly adversely affect *Cypripedium fasciculatum* or *C. montanum* populations by reducing or eliminating critical mycorrhizal associates.

A passive or active crown fire may indirectly affect the fungal species (*Boletus pulcherrimus*, *Phaeocollybia olivacea*) residing in non-riparian zones if suitable habitat elements are impacted. For example, if canopy removal is extensive enough to drastically reduce adequate moisture levels, or if the mycorrhizae on tree roots are damaged, individuals would be indirectly affected. The overstory within these species riparian habitat, however, would burn with low intensities and thus the aforementioned elements of suitable fungi habitat would be retained. A passive or active crown fire would result in an indirect minor long-term adverse effect as some suitable fungi habitat would be damaged and/or the mycorrhizal associates of *Boletus pulcherrimus* or *Phaeocollybia olivacea* would also be reduced. Some populations and their associated habitat, however, would remain or recover in the long term (>20 years).

Species growing on rocky outcrops (*Erythranthe taylori*, *Erythronium shastense*, *Lewisia cantelovii*, *Sedum obtusatum* ssp. *paradisum*), would likely be at low risk of indirect adverse effects from canopy loss since there is little surrounding overstory vegetation within that habitat. Species such as *Clarkia borealis* ssp. *borealis* and *Fritillaria eastwoodiae* that grow in somewhat open-canopy areas (or along roadsides) may experience an indirect adverse effect from canopy loss in cases of active crown fire where large portions of the canopy are consumed.

Active crown fire is modeled for <1% of the habitat for all of these species thus the indirect adverse effect would be minor (due to the small area) but may also be long term. Passive crown fire, however, would occur within approximately 9% of these species habitat would have a moderate short-term beneficial effect on these species by creating more edge-canopy gap habitat (i.e., limiting encroachment by dense shrubs or trees). For example, it has been noted that *F. eastwoodiae* needs some canopy openings to maintain viability. As previously noted, a *Clarkia borealis* ssp. *borealis* occurrence can be found at the site of a previous (1992) high severity fire and another occurrence with several thousand plants can be found on a roadcut and gravel roadside and fill slope.<sup>101</sup> Thus, some canopy reduction would result in a long-term minor beneficial indirect effect to these species.

*Eriastrum tracyi* occurs in openings in cismontane woodlands or chaparral and has been anecdotally noted to withstand minor disturbances, although empirical research supporting this observation is lacking.<sup>102</sup> Passive and active crown fires would remove some or all chaparral, hardwood, and conifer canopy cover. Passive crown fire or low-intensity surface fire would likely have a short-term, minor indirect beneficial effect of providing canopy openings and reducing an

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<sup>101</sup> Nelson 2012a personal communication

<sup>102</sup> USDA Forest Service 2012b

overly-dense vegetative condition for this species. A high-intensity surface fire would have a negligible short-term effect due to the small area predicted for this.

Indirect effects to all Sensitive botanical species may also occur from a potential increase in available habitat for invasive weeds.<sup>103</sup> This would depend on many factors such as distance to already-established invasive plants, season of burn (e.g., a spring burn may mean lower fuel consumption and less bare substrate exposed for invasives), distance to roads or other disturbed areas, the species in question, etc. In particular, *Neviusia cliftonii* has at least one occurrence near a large Himalayan blackberry (*Rubus armeniacus*) population; however, the incorporation of botanical design features would minimize this adverse indirect effect to this species.

Additionally, as previously noted, *Neviusia cliftonii* does not solely reside in riparian areas, so passive crown fire (modeled to occur in 9% of *N. cliftonii* habitat) may have dry enough vegetation nearby to carry fire. As less than 1% of the habitat would experience an active crown fire, the adverse indirect effects would likely be minor and short term. The reduction in surrounding vegetation from surface fire, however, could favor *N. cliftonii* as competition for resources would be reduced. Furthermore, *N. cliftonii* is a rhizomatous plant that allows for resprouting. Many rhizomatous plant species are known to respond favorably to fire and minor disturbances.<sup>104</sup> These conditions could result in increased vigor and distribution of this species, which would be a long-term moderate beneficial effect.

### Hand Thin, Prune, Pile Burn

Hand thinning and pruning of small trees and brush, followed by hand piling and pile burning or underburning would likely result in minor indirect affects (both beneficial and adverse) to botanical species.

If encroachment of habitat by dense shrubs or trees limits openings for species such as *Clarkia borealis* ssp. *borealis*, *Erythranthe taylori*, *Fritillaria eastwoodiae*, *Lewisia cantelovii*, *Sedum obtusatum* ssp. *paradisum* or *Vaccinium shastense* ssp. *shastense*, the proposed density reduction through hand thinning may improve habitat conditions for these species throughout the project area. *Sedum obtusatum* ssp. *paradisum*, however, can grow in the partial shade of tree or shrub canopy thus the effect of canopy-opening for this species may be more minor. *Neviusia cliftonii* may also respond well to an opening of the canopy through hand-thinning, as illustrated by a population in Squaw Creek which was logged in the past<sup>105</sup>, however further study is needed.

As noted previously, pile burning would result in localized areas of high soil heating under piles although as these areas would be minimal in extent the effects would not be detrimental to soil properties on the greater landscape.<sup>106</sup> As also noted, identifiable FSS botanical species would be avoided. High soil temperatures could have indirect adverse effects to these species via: 1) damage to mycorrhizal associates of some species (e.g., *Boletus pulcherrimus*, *Cypripedium fasciculatum*, *C. montanum*, or *Phaeocollybia olivacea*) thus reducing the vigor of these FSS botanical species. In addition, native seedbanks of these species could also be reduced or eliminated in these localized areas. Design features would minimize potential impacts to riparian species by limiting construction or burning of piles within riparian reserves (see Chapter 2 EIS).

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<sup>103</sup> Keeley 2006

<sup>104</sup> Fites-Kaufman et al. 2006

<sup>105</sup> Nelson 2012a personal communication

<sup>106</sup> Project Physical Sciences report

Additionally, if soil sterilization were to occur due to high temperatures this would create small areas of hydrophobic soils resulting in reduced infiltration, increases in erosion, and decreases in water and nutrient availability – thus decreasing suitable habitat for Sensitive botanical species. More suitable habitat would be created, though, for noxious weeds which can colonize and thrive in such environments.<sup>107</sup> The limited extent of this proposed treatment (less than 1% of either action alternative), however, coupled with the indirect beneficial effects, would limit the adverse indirect effects to minor and short term.

## ***Cumulative Effects***

As discussed in the Fire, Fuels, Air Quality and Vegetation report, there is an accumulation of very dense surface and ladder fuels within the project area, increasing the likelihood of high-severity effects in the event of a wildfire. The Proposed Action would reduce the risk of high-severity fire resulting from the cumulative effects of a previous history of fire suppression, a buildup of ground and ladder fuels in the treatment units, and the potential for fire ignitions from the ongoing recreational (boating, hiking, camping) activities in the analysis area. When combined with past projects (e.g., the Green Mountain Vegetation Management Project) and other current and future projects the collective benefit of reducing fire hazard across a broad landscape can be realized.<sup>108</sup> Additionally, past fire events (e.g., Bear Fire, Jones Fire, and Stein Fire) have already likely reduced habitat for certain FSS botanical species in the analysis area (with the potential exception of *Clarkia borealis* ssp. *borealis*), thus the action alternatives would mitigate this loss by preventing further loss in the event of a wildfire.

Past wildfires and current or future actions involving ground-disturbing activities (e.g., timber harvest on private lands, the I-5 Corridor project) may exacerbate the noxious weed situation thus reducing habitat for FSS botanical species. Cumulatively the action alternatives from the Green-Horse project may have a moderate long-term adverse effect of increasing habitat for or the spread of such weeds. The implementation of design features within the Green-Horse project, coupled with noxious weed removal activities such as the Packer's Bay project (see table 1 above) would reduce the cumulative effects to negligible-to-minor long-term. In particular, the Packer's Bay project would have long-term beneficial impacts to native vegetation, particularly a documented population of *Neviusia cliftonii*, due to the reduction of invasive brooms (*Cytisus scoparius*, *Genista monspessulana*, and *Spartium junceum*).

A secondary benefit of the prevention of high-severity fire is the prevention of a potential weed infestation that often results from these types of fires and their corresponding suppression activities. The prevention of a weed infestation would benefit all botanical species analyzed in this report by avoiding competition that could lead to a decline in native vegetation and FSS botanical populations – and their viability.

If Shasta Dam were raised by 18.5 feet<sup>109 110</sup> (as is currently proposed by the Bureau of Reclamation) approximately 2,498 acres of land would be inundated (1015 within the project area), which would account for a minor loss (maximum 2%) of potential suitable habitat for all

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<sup>107</sup> Keeley 2006

<sup>108</sup> Project Fire, Fuels, Air Quality and Vegetation report

<sup>109</sup> Shasta Dam raise lake inundation GIS data were provided from Shasta-Trinity N.F. personnel. The data pertains to 1090' contour elevation information around the shoreline of Shasta Lake in Shasta County, California. The contour line was extracted from CAD data that were generated through a photogrammetry contractor per the direction of the Bureau of Reclamation.

<sup>110</sup> USDI Bureau of Reclamation (BOR) 2007

species discussed in this report; however, the effect would be long term. This would likely affect riparian-associated species (e.g., *Lewisia cantelovii*<sup>111</sup>, *Neviusia cliftonii*, and *Vaccinium shastense* ssp. *shastense*) more than upland species.

With regard to particular species populations – of the 21 occurrences of *Neviusia cliftonii*, approximately 10 are modeled for inundation in the event of an 18.5 foot Shasta dam increase. Three of the eight occurrences of *Neviusia cliftonii* that are documented within the project area are modeled for inundation. Additionally, there are four known occurrences of *Neviusia cliftonii* within the I-5 Corridor project area (two modeled for inundation). Furthermore, two populations of *N. cliftonii* on private land are vulnerable to commercial impacts of limestone quarrying.<sup>112</sup> Thus, if the five non-inundated *N. cliftonii* occurrences within the project area were to be adversely affected by a severe wildfire, a total of 15 out of the 21 known occurrences of *Neviusia cliftonii* would experience major adverse effects over the long-term. Therefore, the reduction of high-severity effects from a wildfire from either action alternative within the Green-Horse project would have a major long-term beneficial effect to this species.

As previously noted, since it is currently unknown how *N. cliftonii* responds to fire, it is possible that some adverse or beneficial effects to this species may result from either action alternative within the Green-Horse project area. The adaptive management strategy proposed, however, would allow for adjustments to implementation based on monitoring this species' response to prescribed fire. Additionally, the proposed actions would occur over a period of 7-10 years with only portions of the project area being burned at different intervals. Due to the distributed nature of the *N. cliftonii* occurrences within the project area, this would result in only a subset of the populations having treatments applied nearby in any given entry. Cumulatively, then, the effects from either action alternative would not lead to a trend toward federal listing for this species.

Of the five *Fritillaria eastwoodiae* populations within the project area, two are modeled for inundation (none of the populations within Alternative 3 boundaries are modeled for inundation). Two additional populations are documented in the analysis area within the I-5 Corridor project area. Although a wildfire event in the project area, coupled with other potential project effects, could have an adverse effect on this species, the high number of occurrences throughout northern California (212) would allow for some loss without likely leading to a trend toward federal listing.

Neither of the two occurrences of *Clarkia borealis* ssp. *borealis* within the project area (Alternative 2 or 3) is modeled for inundation; however, one is modeled for active crown fire and very high flame lengths in the event of a wildfire event, and the other falls within an approved (in 2007) clearcut polygon on private land. Two populations outside of the project area (near Campbell Creek and Sugarloaf Creek) are modeled for inundation. Although a wildfire event in the project area, coupled with other potential project effects, could have an adverse effect on this species, the moderate number of occurrences throughout Shasta County (47) would allow for some loss without likely leading to a trend toward federal listing.

Regarding species eligible for sensitive status - no populations of *Erythronium shastense* are modeled for inundation however some occurrences of *Erythranthe taylori* and *Vaccinium shastense* ssp. *shastense* may be in the inundation zone on the east side of the McCloud Arm of Shasta Lake and Little Backbone Creek on the Sacramento Arm of Shasta Lake, respectively (Nelson personal communication 2015). Although a wildfire event in the project area, coupled

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<sup>111</sup> USDA Forest Service 2012b

<sup>112</sup> Ibid

with other potential project effects, could have an adverse effect on these species, the limited number of occurrences affected, as well as the potential for more existent occurrences of these species not-yet-identified would allow for some loss without likely leading to a trend toward federal listing.

As noted previously, there are no known occurrences of the remaining species within the project area; however, habitat does exist.

One population of *Lewisia cantelovii* (outside the analysis area) is modeled for inundation. As was noted previously, there would likely be negligible direct or indirect adverse impacts to this species as a result of implementing either action alternative thus the cumulative impacts would also remain negligible.

No other populations of the target species are modeled for inundation; however, there is some habitat loss predicted for all of them (see previous). Other activities, such as timber harvest on private or public lands, when paired with a severe wildfire, could cumulatively adversely affect these species. Although future projects in the analysis area (e.g., the I-5 Corridor Project, the Packers Bay Invasive Species Removal, continued Bear fire restoration efforts, and the Northwoods Vegetation Management Project, and the remaining Green Mountain project treatment units) may offset some of the potential adverse impacts from wildfires to populations of FSS botanical species in the area, a high-severity wildfire event would likely have major adverse effects for Sensitive botanical species; especially those requiring moist, shady environments (e.g., *Boletus pulcherrimus*, *Cypripedium fasciculatum*, *C. montanum*, or *Phaeocollybia olivacea*).

## Effects Unique to Alternative 2

### Forest Plan Amendment

Modifications of the forest plan requirement for an average of 20 tons per acre of unburned dead/down material for Management Prescription II (Limited Road Motorized) to an average of 5 – 15 tons/acre. Management direction for Management Prescription III (Road Recreation) would allow fuels reduction treatment of these areas. Dead and down material would be reduced; however, surface organic matter would still exist to protect soils. Conversely, if the area is not treated, the risk to soil productivity is much greater from a high severity wildfire. Modification of the dead/down requirement, then, indirectly benefits FSS botanical species.

### Dozer Line Construction or Reconstruction

Within the Alternative 2 treatment area, approximately 4 acres are proposed for dozer line construction or reconstruction (see figure 2-1 EIS). No dozer lines, however, would be constructed within 50 feet of any documented FSS plant species populations. Unknown occurrences, however, could be directly affected via the crushing/trampling of aboveground portions of plant tissues. Additionally, belowground plant tissues could be directly damaged causing mortality. Indirect adverse effects would include the creation of a bare soil substrate which could: 1) increase erosion and soil loss thus destabilizing suitable habitat for FSS botanical species; 2) increase solar radiation to the soil (thus drying it out) via the removal of litter and

duff; and 3) increase the available habitat for noxious weeds,<sup>113</sup> which may then displace native species. See Chapter 2 of the EIS for specific design features included to minimize these aforementioned impacts.

There are no noxious weed occurrences documented within these areas; however, field surveys did not comprehensively cover all proposed dozer line acres. Therefore, unknown invasive occurrences may exist. Additionally, weed seed may lie dormant in the soil and sprout after line construction; and weed propagules may be brought in unintentionally on the dozer equipment or boots of equipment operators. Some soil compaction – which would also reduce FSS botanical species' habitat quality – could also happen as a result of dozer line creation. Design features (see supplemental report) would minimize the likelihood of weed introduction or spread, however a minor-to-moderate adverse effect could still occur.

Indirect beneficial effects include the possible creation of habitat for Sensitive botanical species known to be disturbance followers (e.g., *Clarkia borealis* ssp. *borealis*).

The dozer lines would be constructed/reconstructed along ridgelines in primarily mid-seral Douglas-fir – Pine and/or Black Oak vegetation types between elevations of 1100 to 2500 feet. Habitat for *Boletus pulcherrimus*, *Cypripedium fasciculatum*, *C. montanum*, and *Lewisia cantelovii* does not exist in this area therefore there would be no effects to these species from this treatment. It is very unlikely, but possible, that *Erythronium shastense*, *Mielichhoferia elongata*, *Neviusia cliftonii*, *Phaeocollybia olivacea* or *Vaccinium shastense* ssp. *shastense* could occur in these areas. Species most likely to occur within these proposed lines include: *Eriastrum tracyi*,<sup>114</sup> *Sedum obtusatum* ssp. *paradisum*, *Clarkia borealis* ssp. *borealis* *Erythranthe taylora* or *Fritillaria eastwoodiae*.

Cumulatively, as this treatment covers only 4 acres of potential habitat, dozer line construction or reconstruction coupled with the previously mentioned past, current, and foreseeable actions (table 1) would likely have short-term negligible beneficial effects to *Clarkia borealis* ssp. *borealis*. There would be short term minor and long term negligible adverse impacts to *Eriastrum tracyi*,<sup>115</sup> *Erythranthe taylora*, *Vaccinium shastense*, *Sedum obtusatum* ssp. *paradisum*, *Clarkia borealis* ssp. *borealis*, *Fritillaria eastwoodiae*, *Neviusia cliftonii*, or *Phaeocollybia olivacea*. There would be no effect to *Boletus pulcherrimus*, *Erythranthe shastense*, *Cypripedium fasciculatum*, *C. montanum*, and *Lewisia cantelovii*.

## Determination

Based on the above analysis of the proposed Green-Horse project, using the most current available scientific information, it is my determination that:

Implementation of the project (either action alternative) may affect, but is not likely to lead to a trend toward Federal listing or loss of viability for 11 Forest Service Sensitive vascular plant, lichen, bryophyte, and fungi species analyzed in this report (*Boletus pulcherrimus*, *Clarkia borealis* ssp. *borealis*, *Cypripedium fasciculatum*, *Cypripedium montanum*, *Eriastrum tracyi*, *Fritillaria eastwoodiae*, *Lewisia cantelovii*, *Mielichhoferia elongata*, *Neviusia cliftonii*, *Phaeocollybia olivacea*, and *Sedum obtusatum* ssp. *paradisum*) or for the three species that are

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<sup>113</sup> Merriam et al. 2006

<sup>114</sup> USDA Forest Service 2012b

<sup>115</sup> Ibid.

eligible for Forest Service Sensitive status (*Erythranthe taylori*, *Erythronium shastense*, and *Vaccinium shastense* ssp. *shastense*)

## Compliance with the Forest Plan and Other Regulatory Direction

With incorporation of the proposed design features, implementation of either action alternative would be consistent with direction provided in the forest plan, FSMs, and other applicable policies, laws, and direction (see Regulatory Framework section of this report) for preservation of botanical resources within the project area. The no action alternative would also meet regulatory direction, at least in the short term. However, the long-term consequences of continued accumulation of historically-departed fuel levels would increase the likelihood of large, high-severity fires that could degrade those aforementioned values.

## Monitoring

Prescriptive objectives would be monitored and documented during project implementation and would be site-specific. This monitoring would include objectives described in the design features specific to this project and associated standards and guides from the forest plan, FMP or other documents that offer direction and guidance for management.

Post implementation monitoring would be conducted as funding and Forest priorities allow. This monitoring would be programmatic in scope and would be based on a landscape approach to assist in determining the influence of this project on ecological processes at a macroscopic scale.

In particular, design features have been included to require monitoring of *Neviusia cliftonii* and removal of nearby invasive plants if project implementation results in increases of these invasive plants. Additionally, a monitoring study is underway for *N. cliftonii* with respect to the effects of prescribed fire on this species. The adaptive management strategy for either action alternative would allow for adjustments in implementation based on various elements including the discovery of unintended/unwanted impacts from the previous year's prescribed fire.

# Biological Assessment

This Biological Assessment (BA) analyzes the potential effects of the proposed USDA Forest Service action, the Green-Horse Habitat Restoration and Maintenance Project, on threatened or endangered species listed under the Federal Endangered Species Act (ESA) or on their designated critical habitat.

In accordance with the ESA and regulatory guidance, we consider:

- only those organisms that appear on the official species list, and
- only those species under the regulatory jurisdiction of the U.S. Fish and Wildlife Service (USFWS). If warranted for analysis, species found on this list under the jurisdiction of the National Marine Fisheries Service (NMFS) will be considered in a separate document.

Species that are not likely to be affected by the proposed action will be considered briefly and eliminated with justification from further, more detailed consideration. We will consider in detail those species that may be present in the action area and are likely to be affected by the proposed action. We will also consider the effects of the proposed project on the primary constituent elements (PCEs) and/or physical and biological features (PBFs) of designated critical habitat that is likely to be affected by the proposed actions.

This document is prepared in accordance with the requirements of the ESA and its implementing regulations. It is also prepared in accordance with current Forest Service policy and follows the standards established in Forest Service Manual direction (FSM 2670) and the guidance provided in the USFWS Consultation Handbook (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998). Additionally, this BA is prepared in collaboration with the USFWS as agreed upon under the Consultation Streamlining Guidance.

This analysis is based on the best scientific and commercial data available at the time this document was written. This includes information such as data collected from Forest databases, remote sensing vegetation analysis, and direct surveys in the field, the most recent and appropriate scientific research or species information, and direct observation on site visits to the project area.

The Shasta-Trinity National Forest (STNF) accessed the most recent list of endangered, threatened, or proposed species (see project file) that may occur in the vicinity of the project from the USFWS web site dated July 2, 2014. ([http://www.fws.gov/sacramento/es/spp\\_list](http://www.fws.gov/sacramento/es/spp_list)). The following quads were queried from the USFWS website:

- Goose Gap
- Minnesota Mtn.
- Devil's Rock
- O'Brien
- Bella Vista

No botanical species and/or Critical Habitats listed as Threatened, Endangered, or Proposed were associated with the four USGS quads within which the project area occurs. Therefore, no

botanical species will be further analyzed in this report. No TEP plants nor Critical Habitat are documented within the boundaries of the Shasta-Trinity NF.

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## Appendix A: Sensitive Plant Species Analysis

**Table A1. Sensitive, ‘Eligible for Sensitive’ or Endemic Botanical Species Known or Suspected to Occur on the Shasta-Trinity National Forest and Probability of Occurrence within the project area**

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<b>Vascular Plants</b>		
<i>Anisocarpus scabridus</i> (= <i>Raillardiopsis scabrida</i> ) rough raillardella	Rocky, open subalpine slopes; 5500-7500 feet elev. High North Coast Ranges, High Cascade Range. Elevation of project area too low.	N (no habitat)
<i>Botrychium crenulatum</i> scalloped moonwort	Bogs and fens, lower montane coniferous forest, meadows and seeps, marshes and swamps (freshwater); 4900-10,760 feet elev. High North Coast Ranges, High Cascade Range, High Sierra Nevada, San Gabriel Mountains, San Bernardino Mountains, Warner Mountains, East of Sierra Nevada; to Washington, Montana, Utah. Elevation of project area too low.	N (no habitat)
<i>Botrychium minganense</i> Mingan moonwort	Lower montane coniferous forest (mesic); 4900-6000 feet elev. High Cascade Range, High Sierra Nevada, Warner Mountains; to Alaska, eastern North America, Iceland. Elevation of project area too low.	N (no habitat)
<i>Botrychium pinnatum</i> northwestern moonwort	Lower and Upper montane coniferous forest; meadows and seeps; 5841-6731 feet elev. Klamath Ranges (Etna Mills, Siskiyou Co.), High Cascade Range (Mount Shasta, Domingo Lake se of Lassen Peak), central High Sierra Nevada (Bond Pass, Tuolumne Co.); to Alaska, central Canada, Colorado. Elevation of project area too low.	N (no habitat)
<i>Botrychium pumicola</i> pumice moonwort	Open volcanic soil, pumice fields or pumice scree; 8,856–9184 feet elev. High Cascade Range (Diller Canyon, Mount Shasta); to Oregon (Crater Lake to Three Sisters region). Elevation of project area too low.	N (no habitat)
<i>Calochortus greenei</i> Greene's mariposa lily	Red fir forest. Northern Juniper woodland; 3400-6200 feet elev. Eastern Klamath Ranges, nw Cascade Range, western Modoc Plateau; southern Oregon. Elevation of project area too low.	N (no habitat)
<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i> Long-bearded star-tulip	Seasonally wet east-side meadows with heavy clay soils within pine forest or sagebrush communities; 3000-4300 feet elev. High Cascade Range, Modoc Plateau; to south-central Washington. No vernal wet meadows with heavy clay soils.	N (no habitat / outside range)
<i>Campanula shetleri</i> Castle Crags harebell	Granite and diorite cliffs; north & northeast exposures, Castle Crags endemic; 3600-3810 feet elev. Out of geographic area.	N (outside range, no habitat)
<i>Campanula wilkinsiana</i> Wilkins' harebell	Streambanks & springs in red fir and subalpine forests; 4840-8600 feet elev. Klamath Ranges, High Cascade Range (Mount Shasta). Outside geographic area. Elevation of project area too low.	N (outside range, no habitat)

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<i>Chaenactis suffrutescens</i> Shasta chaenactis	Rocky open slopes, cobbly river terraces; on ultramafic soils or glacial till w/ ultramafics included; elevation 2600-6900 feet elev. Eastern Klamath Ranges, north High Cascade Range. No serpentine soils in project area.	N (no habitat)
<i>Clarkia borealis</i> ssp. <i>borealis</i> Northern clarkia	Chaparral, cismontane woodland, lower montane coniferous forest; elevation 1300-4400 feet elev. Shasta, Trinity Cos.	Y
<i>Collomia larsenii</i> Talus collomia	Alpine rock fields. Upper montane coniferous forest; 7000-11,500 feet elev. High Cascade Range (Lassen, Magee peaks, Little Mount Hoffman); to Washington. Elevation of project area too low.	N (no habitat)
<i>Cordylanthus tenuis</i> ssp. <i>pallidus</i> pallid bird's-beak sensitive	Lightly disturbed openings in ponderosa pine forest; gravelly volcanic or ultramafic soils; elevation 3600-5200 feet. High Cascade Range (near Black Butte, Siskiyou Co.) Out of geographic area	N (outside range, no habitat)
<i>Cypripedium fasciculatum</i> Brownie lady's slipper	Mixed conifer or oak forests on a variety of soil types, often but not always associated with streams; 1300-3810 feet elev. Northwestern California, Cascade Range, n Sierra Nevada, sw San Francisco Bay Area; to Washington, Montana, Wyoming, Colorado. Widespread but sporadic.	Y
<i>Cypripedium montanum</i> mountain lady's slipper	Mixed conifer or oak forests on a variety of soil types, often but not always associated with streams; 1300-3810 feet elev. Northwestern California, Cascade Range, n&c Sierra Nevada, sw San Francisco Bay Area, Modoc Plateau; to Alaska, Montana, Wyoming. Widespread but sporadic.	Y
<i>Draba carnosula</i> Mt. Eddy draba	High elevation ridges and summits on rocky ultramafic soils; 6000-9000 feet elev. Klamath Ranges (Mount Eddy area, Trinity, Siskiyou cos.). Elevation of project area too low.	N (no habitat)
<i>Epilobium oregonum</i> Oregon willow herb	Wet, gently sloping stream banks, meadows, & bogs, generally on ultramafic soil; 500-7800 feet elev. Klamath Ranges, Outer North Coast Ranges; sw Oregon. Riparian areas intermittent, meadows dry most of the year and no ultramafic soil.	N (no habitat)
<i>Eriastrum tracyi</i> Tracy's eriastrum	Chaparral, cismontane woodland often along roads; 1,033-5,397 feet elev. Substrates described as gravelly shale above compacted clay soil, gravelly loam, coarse granitic sand, stony clay loam, or adobe. Klamath Ranges, northern Inner North Coast Ranges, southern Sierra Nevada Foothills, San Francisco Bay Area, Modoc Plateau (ne Shasta Co.)	Y
<i>Eriogonum alpinum</i> Trinity buckwheat	Exposed, rocky serpentine ridges & slopes; 6700-9000 feet elev. Eastern Klamath Ranges (Mount Eddy area, s Siskiyou, ne Trinity cos.). No serpentine in project area. Elevation of project area too low.	N (outside range, no habitat)

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<i>Eriogonum ursinum</i> var. <i>erubescens</i> sulphur flower buckwheat	Chaparral or lower montane rocky, talus slopes; 5000-6000 feet elev. Klamath Ranges (Scott Bar Mtns, Siskiyou Co.; Trinity Mtn, Trinity Co.) Elevation of project area too low.	N (outside range)
<i>Erythranthe taylori</i> Shasta limestone monkeyflower	Primarily limestone cliff faces & outcrops, Douglas fir/Ponderosa Pine or Black Oak overstory; 1,164 – 2,952 feet elev. Shasta Lake region.	Y
<i>Erythronium shastense</i> Shasta fawn lily	Shallow soils in limestone outcrops, with shrub, oak, or conifer associates. 1,200 – 3,344 feet elev. Shasta Lake region.	Y
<i>Frasera umpquanensis</i> (= <i>Swertia fastigiata</i> ) Umpqua green gentian	Cool, moist Douglas-fir/white fir forest margins or openings; 5000-6000 feet elev. South Fork Mountain, Trinity Co., & SW OR. Out of geographic range.	N (outside range)
<i>Fritillaria eastwoodiae</i> Butte County fritillary	Dry benches & slopes, chaparral, woodlands lower mixed conifer openings; volcanic soils; 160-4900 feet elev. Cascade Range (Shasta, Tehama, Butte cos.).	Y
<i>Harmonia doris-nilesiae</i> Niles' <i>harmonia</i>	Rocky ultramafic ridgetops & slopes with Jeffrey pine, gray pine, & shrubs. 2100-5500 feet elev. Rattlesnake Creek Terrane (M261Au) of southern Klamath Ranges south of Hwy 299. Out of geographic range and no serpentine.	N (outside range, no habitat)
<i>Harmonia stebbinsii</i> Stebbins' <i>madia</i>	Chaparral and lower montane coniferous forest on serpentine; elevation 2100-6000 feet elev. No serpentine habitat present.	N (no habitat)
<i>Iliamna latibracteata</i> California wild hollyhock	Conifer forest and streamsides in the Klamath Range; 1600-6600 feet elev. North Coast, Klamath Ranges (Humboldt, Siskiyou cos.), High Cascade Range (Siskiyou Co.); sw Oregon. Outside geographic area.	N (outside range)
<i>Ivesia longibracteata</i> Castle Crag ivesia	Granite & diorite outcrops near and above timberline; Castle Crag endemic; 4400-4800 feet elev. Outside geographic area.	N (outside range, no habitat)
<i>Leptosiphon nuttallii</i> ssp. <i>howellii</i> Mt. Tedoc leptosiphon	Jeffrey pine/incense cedar forest, usually on ultramafic soil; 4000-5000 feet elev. Localized around the base of Tedoc Mountain, Tehama Co. Outside geographic area.	N (outside range)
<i>Lewisia cantelovii</i> Cantelow's lewisia	Moist rock outcrops/cliffs in broad-leaf & conifer forests; 500-3000 feet elev. Klamath Ranges, High Cascade Range, n&s High Sierra Nevada.	Y
<i>Lewisia kelloggii</i> ssp. <i>hutchisonii</i> Hutchison's lewisia	Decomposed granite, slate, volcanic rubble, upper montane conifer forest; 5900–7000 feet elev. Endemic to Butte, Sierra, Plumas, Nevada, El Dorado, Amador, Trinity and Tuolumne Counties. Outside geographic area.	N (outside range)
<i>Minuartia rosei</i> peanut sandwort	Gravelly serpentine barrens & openings in Jeffrey pine/mixed conifer forest. 2500-5800 feet elev. Rattlesnake Creek Terrane (M261Au) of southern Klamath Ranges. No suitable serpentine habitat.	N (no habitat)
<i>Minuartia stolonifera</i> Scott Mountain sandwort	Rocky slopes on ultramafic soils; montane mixed conifer forest; 4100-5300 feet elev. Southern Klamath Ranges (Scott Mtn, Siskiyou and Trinity Cos.). No ultramafic soils, outside geographic area.	N (outside range, no habitat)

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<i>Neviusia cliftonii</i> Shasta snow-wreath	North-facing slopes, sometimes on limestone-derived soils, within riparian zones; 2400-3000 feet elev. Klamath Ranges (near Lake Shasta)	Y
<i>Ophioglossum pusillum</i> Northern adder's-tongue fern	Margins of marshes and swamps; meadows & seeps; 3000 - 6600 feet elev. Eastern Klamath Ranges (Siskiyou Co.), High North Coast Ranges (Lake, Mendocino cos.), n High Sierra Nevada (El Dorado Co.); to Alaska, ne&north-central North America. No swamps or ponds in project area.	N (no habitat)
<i>Parnassia cirrata</i> var. <i>intermedia</i> fringed grass-of-parnassus	Wet areas, lake edges in ultramific soils; 0-9600 feet elev. Klamath Ranges, High Cascade Range; to Washington, Idaho, Nevada. No ultramafic soils in project area.	N (no habitat)
<i>Penstemon tracyi</i> Tracy's beardtongue	Exposed rocky outcrops; 6500-7250 feet elev. Southern Klamath Ranges (n Trinity Co.) Elevation of project area too low.	N (no habitat)
<i>Phacelia cookei</i> Cooke's phacelia	Lightly disturbed openings, ashy volcanic soil; 4100-5000 feet elev. High Cascade Range (Mount Shasta). One known population along N slopes of Mt. Shasta.	N (outside range, no habitat)
<i>Phacelia greenei</i> Scott Valley phacelia	Gravelly serpentized ridges & forest openings; 5000-7000 feet elev. Klamath Ranges. No serpentine, outside geographic area.	N (outside range, no habitat)
<i>Pinus albicaulis</i> whitebark pine	Upper red-fir or subalpine fores; 6500–12000 feet elev. Klamath Ranges, High Cascade Range, High Sierra Nevada, Warner Mountains, East of Sierra Nevada; to British Columbia, Wyoming. Elevation of project area too low.	N (no habitat)
<i>Raillardella pringlei</i> showy raillardella	Wet ultramafic meadows, seeps & streambanks; 4000-7500 feet elev. Klamath Ranges (Trinity Alps, Scott Mtns). No ultramafic wet meadows, outside geographic area.	N (outside range, no habitat)
<i>Rorippa columbiae</i> Columbia cress	Seasonal lakebeds & drainages; 4200-5600 feet elev. Modoc Plateau; to Washington. No seasonal lakebeds or drainages. Outside geographic area.	N (outside range, no habitat)
<i>Sedum obtusatum</i> ssp. <i>paradisum</i> = <i>Sedum paradisum</i> Canyon Creek stonecrop	Rock outcrops (including limestone) in forest or woodland openings; 960-6500 feet elev. Southeastern Klamath Ranges (Trinity Co.)	Y
<i>Silene salmonacea</i> Klamath Mountain catchfly	Serpentine and iron-rich soils in openings, road cuts or mixed-evergreen forest; 2500 to 3444 feet elev. Trinity County – Klamath range. Outside geographic area.	N (outside range)
<i>Streptanthus oblanceolatus</i> Trinity River jewelflower	Endemic to steep metavolcanic bluffs along the gorge of the Trinity River above its confluence with New River – between 800 to 1,600 feet elev. Outside geographic area.	N (outside range, no habitat)
<i>Vaccinium shastense</i> ssp. <i>shastense</i> Shasta huckleberry	Endemic to SE Klamath Mountains in Shasta County, CA. Copper belt soils, streambanks, coniferous forests, or crevices in rocky outcrops 1,069 – 3998 feet elev.	Y
<b>Forest Plan Endemics</b>		

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<i>Ageratina shastensis</i> (= <i>Eupatorium shastense</i> ) Shasta eupatory	Chaparral, lower montane coniferous forest; carbonate or metasedimentary soils. Mainly found on rocky outcrops or substrates; 1300-5900 feet elev. Cascade Range.	Y
<i>Arnica venosa</i> veiny arnica	Mixed conifer, conifer/oak, or black oak forest, especially on ridgetops & old road cuts; 2000-5200 feet elev. Klamath Ranges, High Cascade Range.	Y
<i>Ericameria ophitidis</i> (= <i>Haplopappus ophitidis</i> ) serpentine goldenbush	Serpentine semi-barrens or openings in Jeffrey pine-incense cedar woodland; 2600-5600 feet elev. Southern Klamath Ranges/n High North Coast Ranges. No serpentine in project area.	N (no habitat, outside range)
<i>Eriogonum libertini</i> Dubakella Mountain buckwheat	Openings in Jeffrey pine-incense cedar woodland or chaparral, always on ultramafic soils; 2500-5500 feet elev. Southern Klamath Ranges, n High North Coast Ranges, n Inner North Coast Ranges (Trinity, Shasta, Tehama cos.). No serpentine in project area.	N (no habitat, outside range)
<b>Bryophytes – Sensitive</b>		
<i>Buxbaumia viridis</i> Bug-on-a-stick (moss)	Large diameter, advanced decay logs in riparian habitat in conifer forest. Low elevation to alpine. No large diameter advanced decay logs in riparian habitat.	N (no habitat)
<i>Meesia triquetra</i> three-ranked hump-moss	Bogs and fens, meadows and seeps, subalpine and upper montane coniferous forest; mesic soils; 4300 – 9800 feet elev. Found in CA, MI, MT, NV, NY, VT, WA and Canada. Elevation of project area too low.	N (no habitat)
<i>Meesia uliginosa</i> broad-nerved hump-moss	Bogs and fens, meadows and seeps, subalpine and upper montane coniferous forest. Mesic soils; 4300-9300 feet elev. Found in CA, MI, MT, NY, OR, VT, WA, WI, WY. Elevation of project area too low.	N (no habitat)
<i>Mielichhoferia elongata</i> elongate copper moss	Exposed soil or rock (rock outcrops) containing copper minerals (in this area); roadcuts. Known from the Northern America, Europe and Asia. In California found in the Siskiyou Mountains - Siskiyou, Humboldt, Trinity counties; and the central coast - Santa Cruz county All elevations.	Y
<b>Fungi – Sensitive</b>		
<i>Boletus pulcherrimus</i> red-pored bolete	Mature or late-seral Douglas-fir forest with hardwoods. Known from the Pacific Northwest from British Columbia, Washington, Oregon, and south to northern California	Y
<i>Cudonia monticola</i>	On spruce needle mats and coniferous debris in perennially moist, shady late-seral forest. All elevations. Found in northern Washington, the Cascade Range, the southern end of the Coast Range and mountains of southern Oregon, and from northern California in the Coast Range and Klamath Mountains. No spruce forest present.	N (no habitat)
<i>Dendrocollybia racemosa</i> branched collybia	Nutrient rich leaf mulch or decaying fungi in conifer forest; all elevations Western Trinity & Siskiyou Cos. (Coast and Klamath Ranges). Project area out of geographic range.	N (outside range)

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<i>Phaeocollybia olivacea</i> olive phaeocollybia	Mixed conifer forest containing oak or pine. All elevations. Found in the western United States.	Y
<b>Lichens – Sensitive</b>		
<i>Hydrothyria venosa</i> (= <i>Peltigera hydrothyria</i> ) veined water lichen	Rocks in cool water, perennial, mountain streams. Found in CA, MT, NC, PA, VA, WA and Canada. No suitable riparian habitat present	N (no habitat)

\*Note – most ranges were taken from *The Jepson Manual- Second Edition* (Baldwin et al. 2012). Other ranges were taken from species accounts and Nature Serve.

# Appendix B: Supplemental Botanical Report

## Introduction

### Purpose

The purpose of this report is to describe management direction and address potential impacts of the proposed action for species other than Threatened, Endangered, and Sensitive.

This supplemental report of botanical concerns for the Green-Horse Habitat Restoration and Maintenance Project; other than those addressed in the attached Biological Assessment/Evaluation, are for the following:

- Forest Plan Endemics
- Survey and Manage Species
- Watch List Species

See the Non-Native Invasive Plant Species Report in the project file for a risk assessment for non-native plant species in the Green-Horse project area.

## Current Management direction and Affected Environment

### *Forest Plan Endemic Species*

Forest Plan Endemic plants are rare species confined wholly or mostly to the Shasta-Trinity National Forest. Although they were all once included on the Regional Forester's Sensitive Species List, they were found to be abundant enough locally to no longer warrant Regional status. They are still of local conservation concern because they are nearly or completely restricted to the Shasta-Trinity NF, and are both globally rare and rare within California. Four Forest Plan Endemics described in the Forest Plan occur on the Shasta-Trinity National Forest, *Ageratina shastensis* (Shasta eupatory), *Arnica venosa* (veiny arnica), *Ericameria ophitidis* (serpentine goldenbush), and *Eriogonum libertini* (Dubakella Mountain buckwheat). Forest Plan direction is to afford the same protection to Forest Plan Endemics as to Forest Service Sensitive species.

There is only suitable habitat and appropriate geographic ranges, however, for two of these species: *Ageratina shastensis* and *Arnica venosa* (see Appendix A for criteria). Therefore, there will be no further consideration of *Ericameria ophitidis* or *Eriogonum libertini* in this report. Refer to the project file for information on *Ericameria ophitidis* or *Eriogonum libertini*.

***Ageratina shastensis*** (Shasta eupatory) is a multi-stemmed perennial herb with a woody caudex that is ranked G2 S2 and CRPR 1B.2. It is limited to the eastern Klamath Mountains in Shasta County and it grows in crevices of limestone<sup>116</sup> or metasedimentary rocky substrates soils in chaparral and lower montane coniferous forest, at elevations from 1,200-5,840 feet. There are 16 documented populations of *A. shastensis* on the Shasta-Trinity National Forest. Twelve of these occurrences were revisited in 2010 resulting in 10 relocations and two new occurrences.<sup>117</sup> A total of 10 documented populations of *A. shastensis* occur within the project area – in the Devil's Rock Hosselkus region and upslope of Curl Creek, on limestone substrate, and in mixed

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<sup>116</sup> Hickman 1993

<sup>117</sup> Unpublished survey data from North State Resources.

vegetation types (black oak, Douglas-fir– pine, and some canyon live oak) at Gray Rocks, and North Grey Rocks. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *Ageratina shastensis*.

***Arnica venosa*** (Shasta County arnica) is a perennial rhizomatous herb that is ranked G3 S3.2 and CRPR 4.2. It is endemic to the eastern Klamath Mountains in Shasta and Trinity Counties. This species grows in cismontane woodlands, lower montane coniferous forests, and in open, often disturbed oak/pine woodlands. It is frequently found in disturbed areas like road banks, road cuts, and shaded fuelbreaks<sup>118</sup> at elevations of 1,300 - 4,900 ft. There are 78 populations documented on the Shasta-Trinity National Forest (NRIS). No populations are documented within the project boundary; the closest known occurrence is approximately 1.5 miles away near Dekkas Creek saddle. Approximately 46,075 acres (or 99% of the project area) is modeled for potential suitable habitat for *Arnica venosa*.

There is moderate to high potential for more individuals of *Ageratina shastensis* or new populations of *Arnica venosa* to be present in the proposed treatment units due, in part, to the presence of limestone rock outcrops and disturbed (e.g., roads, firelines, trails) areas. As previously noted, field visits to known occurrence sites of *Ageratina shastensis* on STNF were conducted the summer of 2010 by North State Resources, with many relocations and two new occurrences found.<sup>119</sup> It was also determined based on the field visits and historical documentation that some previously thought to be known occurrences of *Ageratina shastensis* in the Devils Rock-Hosselkus Research Natural Area were only mapped suitable habitat.

The use of mechanical equipment and the creation of piles will be prohibited within areas that have limestone outcrops to protect these sensitive areas for both *Ageratina shastensis* as well as Survey and Manage species such as the Shasta salamander. For documented *Ageratina shastensis* populations that occur within the prescribed underburn fire treatment areas and are not protected by the aforementioned design feature, vegetation would be cut and removed by hand far enough from known populations (with the presence of a botanical monitor) to prevent injury to the plants from fire. If new populations of *Arnica venosa* are discovered before or during implementation, hand lines would be allowed through these populations only with the presence of a botanical monitor to assure a minimization of adverse effects to these populations.

## **Environmental Consequences**

### ***Alternative 1 - No Action***

#### **Direct, Indirect and Cumulative Effects**

As noted in the main report, under the no action alternative, current management activities would not change. No fuels treatment would be implemented to address the purpose and need, and wildfire suppression would continue as directed by the forest plan. Late-successional coniferous forest habitat would likely continue to develop in quality and abundance. Early-seral conifer habitat would continue to develop into mid and late-seral habitat at current rates. Early-seral conifer areas would reduce in species diversity as tree canopies close and shade-intolerant species drop out. With no change in current management of the project area under the No Action alternative, there would be no direct effects.

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<sup>118</sup> Gibson 2011 personal communication

<sup>119</sup> Nelson 2011 personal communication

The Green-Horse project area is identified as being within a high wildfire risk area based on factors such as lightning starts, presence of human activity, and presence of a hazardous fuels condition. Wildland fires and associated suppression efforts that have occurred over the past century have created a large amount of fuels, both standing and down. The continued accumulation of untreated fuels would increase the potential of high-severity fire within the project area. The effects of a wildfire on the botanical species in the project area are dependent on factors such as: 1) the season (e.g., spring, summer or fall), 2) the expected flame lengths, and 3) the type of fire (e.g., surface, passive crown, active crown). If no treatment occurs the current stand densities that have higher fuel loadings and higher fire hazard would be maintained. Not implementing the proposed action could increase the possibility of the project area experiencing high-severity wildfire, which could result in adverse impacts to *Ageratina shastensis* and *Arnica venosa*.

*Ageratina shastensis* and *Arnica venosa* (and their associated ecological communities) evolved in a fire-dependent ecosystem;<sup>120</sup> therefore, they may be expected to survive or respond positively to low or moderate-intensity wildfire. High-intensity wildfires, however, were not historically typical in most coniferous forests in the Klamath Mountains of California thus many native plant species are not resilient to that level of disturbance. An exception to this, however, may be within chaparral shrub communities which have evolved to regenerate following high-intense, stand replacing events.<sup>121</sup> Burning of aboveground reproductive structures or lethal soil temperatures that can kill underground reproductive structures (e.g., the caudexes of both species), which may cause adverse impacts to this species. The downing of trees or snags during a wildfire event could also cause adverse impacts to individuals of these species within the fall-zone of these objects. Additionally, ongoing wildfire suppression methods (as directed by the Forest Plan) could require the creation of fuel breaks which could adversely impact those Sensitive species, or their habitat, which reside in the same spatial location of the necessary firelines.

In the event of an active crown wildfire (63% predicted for the project area), severe modifications in the forest canopy could be significant enough to cause too-high levels of solar radiation; however, for species such as *Ageratina shastensis* and *Arnica venosa* that grow more open environments this may be only a short-term minor adverse impacts due to its association with open canopy areas. Conversely, the opening of the canopy from a dense, shading vegetative condition could have a short-term beneficial effect to these species as well. Additionally, populations of *Arnica venosa* in the nearby Whiskeytown NRA have been anecdotally noted to have benefitted from wildfire<sup>122</sup>

A low-intensity surface fire (31% predicted for the project area) would damage some above-ground portions of individual plants, while underground portions would be unaffected, and plants would recover in the short term. A low-intensity surface fire within *Ageratina shastensis* and *Arnica venosa* habitat would benefit populations indirectly by reducing other vegetation cover and competition for understory resources (moisture, substrate, soil minerals, understory light), resulting in increased viability of these populations, until surrounding vegetation recovers. A high-intensity surface fire (0.03% predicted for the project area) could damage above and below-ground tissues of this plant.

A high-severity wildfire event could also create favorable conditions (e.g., open canopy, decreased number of native species for resource competition) for noxious weed invasion. A

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<sup>120</sup> Skinner et al. 2006

<sup>121</sup> Sugihara et al. 2006

<sup>122</sup> Gibson 2011 personal communication

noxious weed invasion would have the potential to displace *Ageratina shastensis* – for example the *Rubus armeniacus* (Himalayan blackberry) population within 0.25 miles of a known *A. shastensis* occurrence. Although there are no documented occurrences of *Arnica venosa* within the project area, many documented occurrences within nearby areas are roadside, which is also typically favorable habitat for weeds as well. As there are several known occurrences of noxious weeds in the project area at this time (see ‘Non-Native Invasive Plant Species report), this would likely be a moderate long-term adverse effect.

Because no action would be implemented that would be additive to other past, current and reasonably foreseeable actions in the project area, there would be no cumulative effects to *Ageratina shastensis* or *Arnica venosa* with implementation of this alternative. However, if fuels are allowed to continue to accumulate untreated, the likelihood of these high levels of ground and ladder fuels possibly burning, or re-burning in the event of an unplanned fire is increased. This, combined with past fire suppression, past wildfires (see table 1 above) and ongoing fire suppression would create long-term effects such as a highly increased likelihood of a high-severity fire occurring, and thus damaging or killing *Ageratina shastensis* or *Arnica venosa* individuals as well as adversely impacting their habitat. Adversely impacted habitats, then, would have a long-term adverse effect on *Ageratina shastensis* or *Arnica venosa* species abundance and distribution.

### *Alternatives 2 and 3*

#### **Direct Effects**

There are two occurrences of *Ageratina shastensis* within Alternative 2 treatment units and one occurrence within Alternative 3 treatment units. It is unknown how *Ageratina shastensis* responds to fire; therefore, prescribed treatment may directly affect this species. Also anecdotally noted, *Arnica venosa* populations seem to respond well after prescribed burning<sup>123</sup>. Approximately 90-95% of the acreage within Alternatives 2 and 3 is modeled for surface fire. As previously noted it is possible for there to be consumption or damage to botanical species – including occurrences of *Ageratina shastensis* or *Arnica venosa*– from this treatment. All of the surface fire in the project area, though, is modeled for low intensity and very low (less than 1 foot high) to low (1-4 feet high) flame lengths, suggesting that shrub consumption is unlikely. Additionally, both of these species have a woody or scaly stems (caudexes) that produce leaves and could potentially regenerate after a surface fire. For these reasons, any adverse direct effects from this treatment would be minor and short term.

Since the use of mechanical equipment and the creation of piles would be prohibited within areas that have limestone outcrops there should be no direct effects to known occurrences of or primary habitat for *Ageratina shastensis* from these treatments. Of the *A. shastensis* and *Arnica venosa* habitat in the project area, proposed hand treatment areas equal less than 0.5% for Alternative 2 and 0.06% for Alternative 3. Due to this very limited acreage and the fact that *Arnica venosa* is typically associated with disturbed areas, any adverse direct effects from this treatment would be negligible and short term.

As previously noted, there is a small amount (approximately 4 acres) proposed for dozer line construction or reconstruction in Alternative 2 treatment units. These lines do not intersect with any known occurrences of *A. shastensis*. Additionally, as it covers only 4 acres of potential

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<sup>123</sup> Gibson 2011 personal communication

habitat, any direct adverse effects from this treatment would be negligible and short term for both species.

### **Indirect Effects**

If encroachment of habitat by dense shrubs or trees limits openings for *Ageratina shastensis* or *Arnica venosa*, this proposed density reduction through prescribed burning, hand thinning, piling, and pile burning may improve habitat conditions for this species throughout the project area. This density reduction would result in a moderate short term beneficial indirect effect. Passive crown fire is modeled for approximately 9% of potential suitable habitat for both species and active crown fire would occur in less than 1% of this habitat. The remainder (90-95% alternatives 2 and 3) is expected to be low-intensity surface fire. If the overstory canopy were reduced to the point of allowing excessive solar radiation and subsequent drying of the soils, it is possible this would have an adverse indirect effect to *Ageratina shastensis* or *Arnica venosa*; however, as this is modeled for less than 1% of the suitable habitat area, this would be a negligible adverse effect. Conversely, as these species tend to inhabit more open areas the opening of the overstory canopy via passive crown fire, or the reduction of competing vegetation through surface fire, would have a short-term minor beneficial effect to *Ageratina shastensis* and *Arnica venosa*.

### **Cumulative Effects**

As noted previously, there is currently a proposal to raise Shasta Dam. If the dam were to be raised by 18.5 feet, our current GIS records indicate that approximately 2,498 acres of land would be inundated (1,015 acres within the project area). Of the potentially inundated lands, 114 acres are limestone (27 acres within the project area), which would specifically affect species with a limestone affinity - such as *Ageratina shastensis*. In addition, approximately 2% of overall habitat for *Ageratina shastensis* and *Arnica venosa* is modeled for inundation – which includes one of the two known occurrences of *Ageratina shastensis* within the project area.

As there are a limited number of known populations (15) of *Ageratina shastensis*, the potential loss or damaging of two populations within the project area in the event of a wildfire, coupled with the loss of habitat from a rising lake level and possible effects from other projects (I-5, Packer's Bay, Green Mountain, etc.), the result of no action would likely be a moderate long-term adverse effect to this species.

There are 78 documented occurrences of *Arnica venosa* and no known occurrences within the project area. The potential loss of habitat, however, from wildfire, rising lake levels, and possible effects (both beneficial and adverse) to individuals and habitat from other projects (I-5, Packer's Bay, Green Mountain, etc.), the results of no action would likely be a mixture of minor long-term adverse and beneficial effects to this species.

In the absence of high-intensity wildfire within the project area in the future, there would be no direct or indirect effects, therefore no cumulative effects, from the No Action Alternative. As noted previously, the raising of Shasta Dam could impact individuals within the project area. Analyzed with this, any possible adverse or beneficial effects from other foreseeable projects (e.g., I-5 and Packers Bay), and the potential for some direct and indirect effects to *Ageratina shastensis* or *Arnica venosa* from either action alternative, cumulative effects to this species would be moderate and short term.

**Conclusion:** Due to its habitat requirements and the fire type and intensity modeled for the action alternatives, the implementation of either action alternative would likely have a minor-to-moderate beneficial short-term effect for *Ageratina shastensis* and *Arnica venosa* individuals and

habitat. Therefore, either action would not lead to a trend towards federal listing for the either species.

## *Survey & Manage Vascular Plants, Bryophytes, Lichens, and Fungi*

Forest wide standards and guidelines for “Survey & Manage” old-growth associated species were revised in January 2001 and described in the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures, Standards and Guidelines.<sup>124</sup> Four exempted habitat disturbing activities, or projects, are in place from the October 11, 2006 modified injunction order in *Northwest Ecosystem Alliance v. Rey* (Case 2:04-cv-00844-MJP, Doc. No. 109). Thus, these exempted activities (listed below) can proceed and do not require surveys.

- Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;
- Thinning projects in stands less than 80 years old;
- Riparian and stream improvements projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions;
- **The portions of projects involving hazardous fuel treatments where prescribed fire is applied.** Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to survey and manage requirements except for thinning of stands younger than 80 years old.

Specific additional surveys for species described as Survey and Manage under the Northwest Forest Plan were not performed for the proposed project, as non-commercial fuels treatment (i.e. prescribed burning – as in the Green-Horse project) is indicated as exempt from required survey under ‘Pechman Exemptions’. Additionally, the requirements of managing known sites for these species are exempt for all prescribed burn areas under the Pechman Exemptions.

There are approximately 4 acres of dozer line/fireline proposed and 206 acres of hand thinning proposed for the Green-Horse project area. There are no known occurrences of Survey and Manage Species along these areas and there is no suitable habitat along these ridgelines or recreation residence area for those species (as identified by both general botanical field surveys and GIS modeling) therefore no effects for these species is discussed further in this report.

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<sup>124</sup> USDA Forest Service 2001

## Watch List Species

Watch list species are those that either: 1) do not meet the criteria to be included on the Regional Forester's sensitive plant list, but are of sufficient local viability concern to be considered in the planning process or 2) do meet the criteria but are newly described or have other new information available and have not yet been added to the Regional Forester's list. In general, Watch List plants are those that are uncommon and/or there is a lack of substantial information regarding distribution, habitat affinities, responses to management, etc. The Watch list plants in this report were determined from the California Department of Fish and Game's Special Plant List,<sup>125</sup> the U.S. Fish and Wildlife list of species of concern, the California Native Plant Society's ranking system,<sup>126</sup> and the Shasta-Trinity Forest botanist.<sup>127</sup>

No new populations of these species were found during field surveys; however, known occurrences of these plants exist within ten miles of the project area. There are six Watch List species of concern addressed: *Adiantum shastense* (Shasta maidenhair fern), *Calochortus syntrophus* (Callahan's mariposa lily), *Clarkia borealis* ssp. *arida* (Shasta clarkia), *Iliamna bakeri* (Baker's globe mallow), *Streptanthus longisiliquus* (long fruit jewel flower), and *Viburnum ellipticum* (oval-leafed viburnum).

**Table 6. CNPS California Rare Plant and Threat Ranks**

Rank	Description
1A	Plants Presumed Extinct in California
1B	Plants Rare, Threatened, or Endangered in California and Elsewhere
2	Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere
3	Plants About Which We Need More Information - A Review List
4	Plants of Limited Distribution
0.1	Seriously threatened in California
0.2	Fairly threatened in California
0.3	Not very threatened in California

*Adiantum shastense* (Shasta maidenhair fern) is a newly discovered fern endemic to northern California and is currently known only from Shasta County. *Adiantum shastense* grows in western Shasta County, from the McCloud Reservoir south to Hwy. 299E, including most of the more mesic Shasta Lake area at elevations of 1100–2740 ft.<sup>128</sup> *Adiantum* species typically grow in

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<sup>125</sup> CNDDDB 2012

<sup>126</sup> CNPS 2012

<sup>127</sup> Nelson 2011 personal communication

<sup>128</sup> Huiet et al. 2015 in press

shaded hillsides or moist woodlands.<sup>129</sup> *Adiantum shastense* grows on limestone substrates outcrops around the Shasta Lake area but also is widespread on the forest floor. Surveys have recently (2014 and 2015) taken place for this new species, however overall surveys are far from complete at the time of this writing.

*Adiantum shastense* is currently unranked by CNPS however it may be ranked at CRPR 4. It is unlikely that this species will be added to the Forest Sensitive species list, as it is not uncommon within its limited geographic range<sup>130</sup>, however its recent discovery and very limited geographic distributed has warranted a Watch List status for the Green Horse project. There are several occurrences of this species reported to be within the project area (Nelson personal communication 2015) as well as occurrences just east of the boundary along Potem creek as well as four other known occurrences within 3 miles of the boundary.

*Calochortus syntrophus* (Callahan's mariposa lily) is a perennial herb ranked G1 S1.1. This species was recently raised from CRPR 3 to CRPR 1B. No populations are currently documented on the Forest; however, two occurrences are known just east of the project area near the Pit River Reservoir (1700 feet elevation). First described as a species just over a decade ago (Callahan 1993), little is currently known about this species.

*Clarkia borealis* ssp. *arida* (Shasta clarkia) is an annual herb ranked G3T1 and CNPS List 1B.1 and is endemic to California. Six populations are known in Shasta and Tehama Counties with only one occurring on the Forest. This population occurs approximately 2.5 miles southeast of the project area. *Clarkia borealis* ssp. *arida* occurs in openings in gray pine (*Pinus sabiniana*) and black oak (*Quercus kelloggii*) woodlands on southerly to westerly gentle slopes at 1,600 – 1,700 feet elevation.<sup>131</sup>

*Iliamna bakeri* (Baker's globe mallow) is a perennial herb ranked G4 S3.2 and CRPR 4.2. It grows in chaparral, pine or mixed conifer/oak forest, juniper woodland, and on rocky soils at elevations from 3800-6800 feet in the Scott Mountains, Cascades & Modoc Plateau. *Iliamna bakeri* is also a known fire-and-disturbance follower. Eight populations of *I. bakeri* occur on the Forest and two occur approximately ten miles north of the project area.

*Streptanthus longisiliquus* (long fruit jewel flower) is a perennial herb ranked G3 S3.3 and CRPR 4.3. Known from three counties (Butte, Tehama, and Shasta) this short-lived perennial grows on lower montane coniferous forest, often in openings and sometimes in disturbed places.<sup>132</sup> *S. longisiliquus* was recently found on the Forest along Oak Mountain and Pit 7 roads approximately five miles outside of the project area.

*Viburnum ellipticum* (oval-leafed viburnum) is a shrub ranked G5 S2.3 and CRPR 2.3. It grows in chaparral, cismontane woodland, and lower montane coniferous forest communities at elevations ranging from 0 – 4,500 feet. Although there are 29 populations of *V. ellipticum* known throughout California only two are documented on the Forest. Both occurrences are less than two miles from the project area (i.e., Jones Valley Marina and Waters Gulch). The Jones Valley Marina population falls within the modeled inundation area were Shasta Dam to be raised.

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<sup>129</sup> Baldwin et al. 2012

<sup>130</sup> Nelson personal communication 2015

<sup>131</sup> Nakamura and Nelson 2001

<sup>132</sup> Clifton and Buck 2007

Additionally, the *V. ellipticum* population in Jones Valley burned to the ground during the 2004 Bear fire however it has recently been observed to have resprouted and be growing with vigor<sup>133</sup>

The indirect, direct, and cumulative effects for these species relating to all three alternatives are similar to those discussed in the main report. The No Action alternative would increase the likelihood of high-severity (adverse) effects in the event of a wildfire, and the two action alternatives would largely have a beneficial effect to most of these species. See the project file for further information regarding Watch List plants.

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<sup>133</sup> Nelson personal communication 2014

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